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THE

MALAYAN AGRICULTURAL JOURNAL



PRINCIPAL CONTENTS

SOIL SURVEY REPORTS. No. 3, THE TRANS-PERAK SWAMP BY J. K. Coulter, B.Sc. (HONS.), B. AGR., DIP. AGR. SCI. (CAMB.), A.R.I.C., A. R. McWalter, B.Sc. (HONS.) AND G. W. Arnott, B.Sc. (HONS.), D.T.A.

A STUDY OF SOME CULTURAL EFFECTS ON PROTEIN CONTENT OF GUINEA GRASS BY Mohamad bin Jamil, B.Sc., D.I.C.T.A.

THE EFFECTS OF CROP ROTATION ON GROWTH AND YIELD OF PADI BY E. F. Allen, M.A., DIP. AGR. SCI. (CAMB.), A.I.C.T.A.

NOTES ON CURRENT INVESTIGATIONS, JANUARY TO MARCH, 1956.

MECHANISATION. HALF-YEARLY REPORT, OCTOBER, 1955, TO MARCH, 1956.

NOTES ON EXTENSION WORK, JANUARY TO MARCH, 1956.

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(Continued)

THE Malayan Agricultural Journal

Vol. 39, No. 2, 1956.

EDITORIAL

A Soil Survey of the Trans-Perak Swamp. With a view to increased production of rice in Malaya, it has, from time to time, been suggested that the 200,000 acres of mainly swampy land lying west of the Perak River and between Bruas to the north and Kota Stia to the south could, with developed drainage and irrigation, be used for growing padi.

Sixty per cent of the area is under virgin jungle and a further 25 per cent under secondary jungle and lalang (*Imperata cylindrica*), and it is only recently, and through the soil survey reported in this issue of the Journal, that a reliable estimate of the amount of peat land in the area could be given.

The report of the survey estimates that 71,000 acres, or 35 per cent of the area, is peat and unsuitable for wet padi. Unfortunately, the remaining 129,000 acres of mineral soils is not in one block but is scattered, especially in the southern part of the area. The majority of the mineral soils are clays or clay loams which are, from a textural point of view, suitable for padi cultivation.

Although the report has been written with emphasis on the suitability of the area for growing wet padi, the authors also discuss the agricultural potential of the land which is unsuitable for that crop.

Fodder Grasses in Malaya. Recent issues of the Journal contained an article summarizing the post-war work of the Department of Agriculture on the cultivation of fodder grasses and describing trials carried out at the Federal Experiment Station, Serdang, to measure the yield responses of Guinea grass to varying applications of fertiliser.

The opportunity was taken to use two of these trials as a basis for the examination of the evidence produced by the chemical analyses of the grass and to study the effects on the protein content of the grass of using different quantities of fertiliser at different times.

Enche Mohamad bin Jamil describes the trials and discusses the results in the second article in this issue.

Off-Season Cropping of Padi Land. The off-season cultivation of padi lands in Malaya with crops other than padi is limited by circumstances of climate and soil, and, occasionally, by an economic factor. However, there are areas where crop rotation can be and is practised, especially in Kelantan, Malacca and Selangor.

Trials have shown that the beneficial effect of a rotation crop on the subsequent padi crop is considerable, and, therefore, the Department of Agriculture gives every encouragement to farmers who are able and willing to till their land the year round.

On later pages, Mr. Allen, the Senior Agronomist, reviews the progress of investigations into the planting of a different crop in the padi off-season.

SOIL SURVEY REPORTS. No. 3, THE TRANS-PERAK SWAMP.

With Particular Reference to its Development for Padi Cultivation.

BY

J. K. COULTER, A. R. MCWALTER and G. W. ARNOTT,

Soils Division.

Introduction.

Soil surveys provide a basis for any programme for developing land for agriculture. In undeveloped country a physical land classification is applicable with little modification to land use planning, the object of which is to make the best use of the soil, i.e. by growing crops which are suited to it. Where an irrigation scheme is being considered, soil and relief are the major factors. Land capability classification for irrigation deserves very careful consideration because a faulty classification may lead to heavy and irrecoverable expenditure.

In this report the greater emphasis has been placed on the potential value of the soils for irrigation for wet padi cultivation, but other possibilities of land use have not been disregarded, e.g. alternative uses of peat. The report differs from nearly all other soil survey reports in that the soil map has been constructed on the basis of laboratory information which was obtained from soil samples taken by persons unskilled in soil survey and that many of the samples were taken from areas with surface water.

The area in question covers some 200,000 acres, is largely swamp, and the amount of peat it contains has been a subject of speculation for many years. From time to time suggestions have been put forward for developing a large drainage and irrigation scheme for padi-growing in the area, the irrigation supply to come from a dam across the Perak River near Parit.

In 1940 and 1941, soil sampling and level surveys were carried out by the Department of Agriculture and the Drainage and Irrigation Department in the Blanja Kiri and Kota Stia—Pasir Salak areas. No maps are available to show the exact location of the survey, though some results of analyses are still extant and show that a considerable number of the samples were peats.

In 1947 and 1948, further measurements of levels were made by the Drainage and Irrigation Department, while the Department of Agriculture took soil samples along the same paths. Levelling and soil sam-

pling continued until 1950, when work was halted due to the Emergency. In 1953, arrangements were made with a firm of Consultant Engineers to extend the survey of levels. Arrangements were also made for the firm to take soil samples at the same time.

Pattern of Land Settlement.

The area consists largely of Malay Reservation, State land, and Forest Reserve. Along the banks of the Perak River there are Malay settlements with cultivation of rubber and *kampong** fruits in the dry parts and padi in the swamp areas. Along the Bruas—Sitiawan road are a number of rubber estates, and to the east of these there is a considerable area of land formerly cultivated by Chinese squatters. They settled in the area illegally during the Japanese occupation of Malaya, felled the jungle and planted crops, including padi. These squatters were resettled in the early days of the Emergency, and the area they once occupied is now partly covered with *belukar* (secondary jungle growth). Comparison of a vegetation map with the soil map shows that this cultivation did not extend very far into the deep peat, although some padi was grown on the shallower peat.

Vegetation.

The area, being largely swampy, consists mostly of swamp forest. It is heterogeneous but on the whole has fewer species because the conditions prevailing, i.e. swamp, peat, and anaerobic and acid conditions, are more selective, and the root system of at least the larger trees has to be specially adapted so that they are stilt-rooted.

Aerial photographs, on a scale of approximately 1:25,000, were available and a vegetation map was drawn from them. From the aerial photographs it is possible to distinguish high jungle, *belukar* and *lalang* (*Imperata cylindrica*), padi cultivation, rubber and *kampong* fruit trees. On a map, four types of vegetation were demarcated, viz. jungle, *belukar* and *lalang*, padi, and rubber and fruit trees. When the soil survey was being carried out, notes on the vegetation were taken and these were correlated with the information from the aerial photographs.

It should be understood that the natural vegetation of the whole area was originally high jungle, and the *belukar* and *lalang* result from felling and burning it. They are not connected with the soil type, though *lalang* is not found on land which is permanently swampy but will grow on drained peat.

From the aerial photographs it was hoped that it would be possible to distinguish differences in the jungle which could be correlated with soil boundaries. For instance, it was thought that there would be marked differences between the jungle growing on deep peat and that growing on clay or shallow peat. Although some differences in the density of the jungle were obvious, these could not be correlated with the soil map.

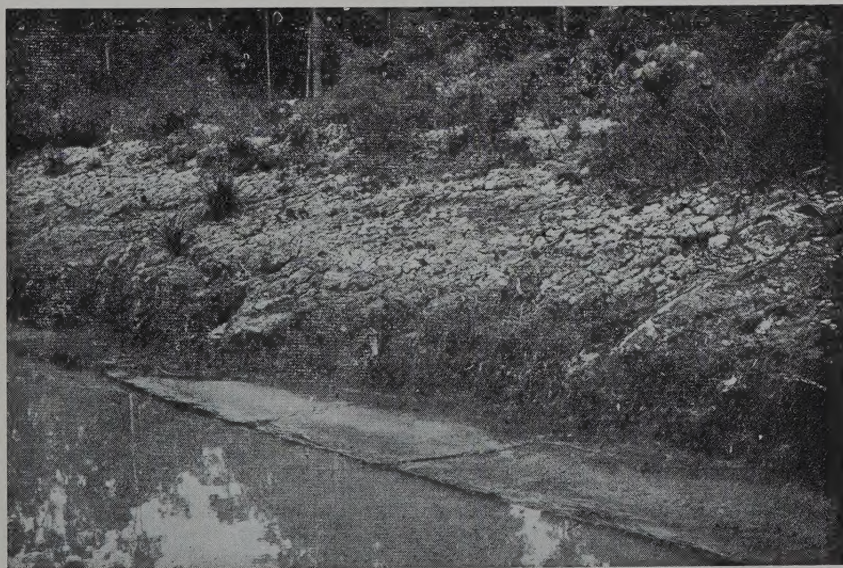
* A village.

PLATE I



General view of the Perak River near Bota.

PLATE II



Side of canal cutting showing clay on top of peat.

PLATE III



Old timber dug up from the peat.

PLATE IV



Swamp jungle trees with stilt roots.

However, in a flight over the region at a height of 1,500 to 2,000 ft., an area of very poor jungle in the south-west was located. This poor jungle, which corresponds with areas of sandy soils and peat over sand, consists of isolated, large trees in a mass of small palms and ferns. The jungle growing on peat in other parts of the surveyed area appeared to be the same as that on the clay. In these areas it is the swampy conditions rather than peat or clay which apparently determine the type of vegetation.

In Table I, the acreages of the different types of vegetation in the the surveyed area have been listed from the vegetation map.

Table I.
Acreages of Different Types of Vegetation.

Vegetation	Size of Area
	acres
Virgin jungle	121,000
<i>Belukar</i> and <i>lalang</i>	59,000
<i>Kampong</i> fruit and rubber trees	15,000
Padi	4,000

The figures are only approximate, but they give an indication of the area under jungle, and hence the area which will have to be cleared when any form of agriculture is introduced.

Drainage and Physical Features.

Much of the area is swamp, with water sometimes as much as four feet deep. How much of it is actually permanent swamp is not known but probably considerable areas are permanently covered with water, because, even during the dry part of the year, the surveyors found surface water in many areas. Drainage of the eastern and southern section of the area is provided by the Perak River and its tributaries. This is a sluggish-moving stream which flows south, south-east, west, north and finally south-west to the sea.

The whole of the area is very flat, and, with the exception of one or two small hills, it is all below the 50 ft. contour. Just to the north of the area is a range of low hills formed of quartzite. The general fall of the land is towards the south-west.

Morphology of the Soils.

The landscape of the area is determined by fluvial and marine phenomena, and practically all the soils in the area are alluvial. Except in the south and parts of the west, the majority of the soils are derived from river-borne alluvium and this gives a somewhat different type of soil and landscape from that found in areas of coastal alluvium, e.g. Tanjong Karang in Selangor, and in Kedah.

Rivers reaching the lowlands overflow their banks during the rainy season and have very extensive flood plains. As the rate of flow decreases, the coarser particles are deposited on the banks, forming sandy levees, while further downstream the finer particles are deposited. At right angles to the river, particles are deposited in decreasing amounts, resulting in depressions on either side of the river, and it is in these that the peat is formed. River alluvium is more irregular than marine alluvium since the deposition of the latter takes place under estuarine conditions. Uniform deposition gives a more uniform surface.

From the aerial photographs there is an indication that the Perak River once flowed in a line more or less parallel to and south-west of the Bruas—Sitiawan road into an inlet south of Lumut.

To the south-west of the area, in the region of Lekir, the soil is very sandy and is possibly derived from old marine deposits.

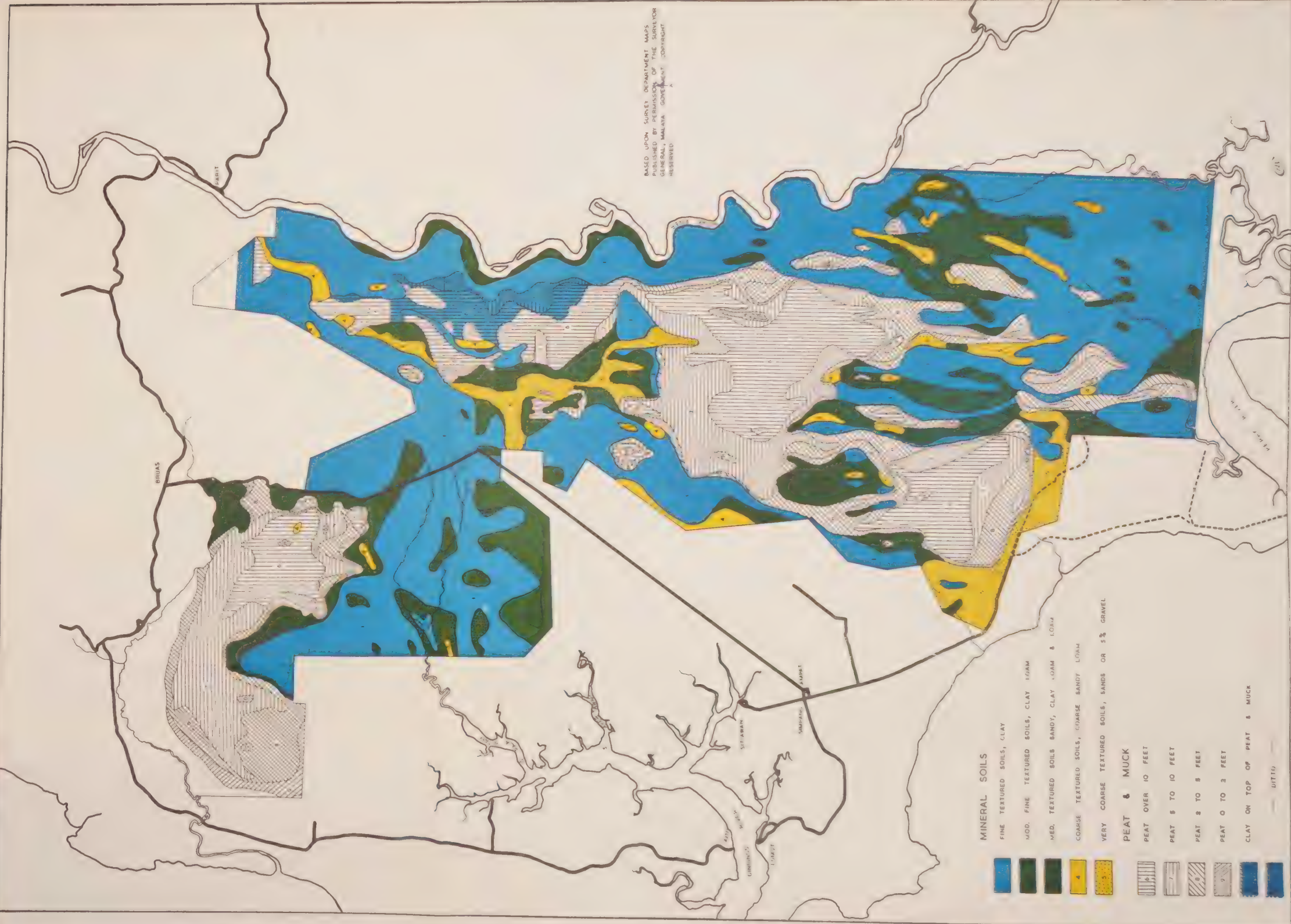
Methods of Soil Survey.

ORGANISATION.

Swamp jungle is so dense that it is necessary to cut paths through it, and the cutting of these forms a very expensive part of a survey. Consequently, in soil surveys, soil sampling is done along the paths cut for the survey of levels. The frequency of soil examination along the paths is a minor consideration as regards cost, but the degree of coverage of any given area depends on the distance apart of the paths.

In the present survey, part of the area was covered with paths half a mile apart, but in the greater proportion they were one mile apart. Samples were taken at intervals of 1,200 ft. in the mile paths and at quarter-mile intervals in the half-mile lines. This gives one sampling point per 145 acres in the mile lines and one per 80 acres in the half-mile lines. This degree of coverage is low, yet it is the best that could be done in the circumstances. As the paths are so far apart there would not be much point in closer sampling within the paths. Since the soil is alluvial, it is the general trend of soil types and not the minor variations which are of greatest interest.

Samples were taken at each of the sample points and were submitted to the Soils Division of the Department of Agriculture for analysis. It might be thought that it would have been sufficient for the sampler to examine the soil as he proceeded along the path and take samples only where variations are noted in the soil; however, for two reasons this was not possible. The first is psychological; the going was extremely difficult



in swamp jungle and there was a very strong tendency, after the initial enthusiasm of the first two hours of the day, for almost the entire attention to be devoted to the "battle for survival". The going may be described as climbing out of a hole, over the top of a large buttress root and falling down a hole on the other side. Under these conditions variations in soil are easily missed, and in fact often cannot be seen because of the covering of water. With systematic sampling more information is obtained. The second reason for collecting the large number of samples for laboratory analysis was that most of the sampling was done by the surveyors engaged on taking the levels. These surveyors had not been trained in identification of soils, though they could distinguish peaty soils from mineral soils. There is a natural tendency, however, to confuse peats and mucks and to call any soil which is brown and has some organic remains, peat. As the samples were taken, notes were made on the colour of the soil, the depth of the water and the types of vegetation.

METHODS OF SAMPLING.

Since the surface was covered with water, often to considerable depth, sampling was not easy. It would have been desirable to take several samples round one point and bulk these, but this was impossible because a small auger could not be used under the wet conditions. Finally it was decided to take a sample from one point using a six-inch diameter earth auger. A depth of nine inches was taken as the topsoil: this was necessary to secure uniformity since many of the peaty soils are very slushy on top and a sample to a lesser depth would have consisted largely of leaves, twigs, etc. The subsoil sample was taken from nine to eighteen inches in the same hole. If peat or organic soil was present, its depth was measured. At first, a notched stick was used but this was slow and not very accurate. Later, a Hiller-type peat borer was constructed and this could measure the depth of peat with accuracy. The actual depth of the peat was measured down to 10 ft. Depths greater than this were recorded as being more than 10 ft. If the peat was less than five feet in depth, a sample of the underlying material was also obtained for analysis. This was done to get an indication of the sort of material underneath the shallower peat, which, it is expected, will disappear with time. The samples of soil underneath the peat were obtained by using either a six-foot auger (6 in. diameter) or the peat borer. A sample weighing about two pounds was obtained and was put into a numbered, strong, canvas bag for transport to the laboratory. No matter how strong the bag, the wet soil, especially the peat, soon rotted it, so that many bags had to be discarded after the first trip. When the survey was nearly finished it was found that polythene bags could be made very cheaply and that by fitting these inside the numbered canvas bags, samples could be stored for some time without danger of rotting the cloth. Furthermore, the soils were kept in their field state so that changes in pH, etc. were minimised.

LABORATORY EXAMINATION.

Classification.

It is necessary to define briefly the various terms used in this report. From these it will be seen that the popular conception and the scientific definition of a particular term often differ widely.

(i) "Organic Soils" or "Bog Soils".

The term "bog soils" has been proposed to cover the whole group and so avoid the use of the term "peat" for highly organic soils which are not peat in the strict sense of the term. "Peat" can be defined as incompletely decomposed organic debris, i.e. material in which the outlines of plant materials can still be seen. In this report it is taken as material of any depth which has less than 35 per cent mineral matter. Mineral matter is the ash remaining after the soils have been ignited at 800°C. to constant weight.

"Muck" is organic material which has decayed to such an extent that plant remains are well broken down. In this report it is taken as material with more than 35 per cent but less than 65 per cent mineral matter. In the Trans-Perak swamp, muck often includes peat which has had considerable admixture of mineral matter and so has a high ash content.

"Organic clay" is a soil which is predominantly clay but in which there is a fair proportion of decayed organic matter. It is a soil with more than 65 but less than 80 per cent mineral matter.

(ii) Mineral Soils.

The mineral matter of the soil can be divided into the following classes:— clay, silt, fine sand, coarse sand, and gravel. The different fractions are defined by their particle size, i.e. clay includes all particles with an average diameter of less than 0.005 mm.; silt, all particles from 0.005 to 0.05 mm.; fine sand, 0.05 to 1.0 mm.; and coarse sand, 1.0 to 2 mm. The above particle sizes are those given by Bouyoucos for the hydrometer method. More recently the International Method has been introduced.

As it is not possible to classify the mineral soils on their profile characteristics, since the profile cannot be examined because of water-logging, they have been classified on a textural basis. In the past, much attention has been paid to the texture of soils, particularly when deciding their suitability for padi cultivation. Soils with a high clay content were regarded as the best padi soils because they held water better, but where the whole area is flooded and the water table raised to form a complete swamp, as happens in many padi areas, the texture of the soil as a contributing factor towards the holding of water becomes of less importance. Heavy textured soils more probably owe their reputation for being good padi soils to the fact that they are generally richer in plant nutrients,

particularly if laid down under marine conditions. Nevertheless, soil texture is one of the more important properties of a soil because it is one that cannot readily be altered. Man can improve the phosphate status, for example, or he may decrease the acidity, but he cannot, except at great expense, alter the texture.

Details of Analyses.

On arrival at the laboratory, the pH of the wet sample is measured by means of a glass electrode. The samples are then sun-dried in wooden trays, ground with a wooden pestle and mortar, and passed through a 2 mm. sieve. All analyses are carried out on air-dried samples and results are reported as such.

Further reference will be made to the results of these analyses later in the report, but a short discussion here on their limitations and implications would not be out of place. Determination of "readily soluble nutrients" in soils in temperate countries is a well-known tool in advisory work for manurial programmes. However, even in those countries where experiments have been going on for many years and where the reaction to fertilisers is well known, difficulty is still experienced in interpreting results. Very little critical work along these lines has been carried out in soils of tropical countries, and with swamp soils the results are even more difficult to interpret. In any discussion of the results of analyses these reservations must therefore be borne in mind.

Considering the results for phosphorus, it cannot be said with certainty that soils with low value for readily soluble phosphorus will respond to phosphatic manures; nevertheless the figures, taken over a large area and for a large number of samples, are useful for comparative purposes, and when more is known of responses to fertilisers in the area, these results might be useful.

Similar considerations apply to the results for readily available potassium. Although many high yielding padi soils in Malaya show a high value for readily soluble potassium, and, in fact, are high in bases generally, this does not mean that soils showing low values will necessarily respond to potassium dressings. Indeed, few examples are known where padi has responded to potassium dressings.

As regards conductivity, it is well known that certain Malayan soils contain substantial amounts of sulphur in the form of sulphides and other reduced sulphur compounds, and these can be oxidised to sulphates and sulphuric acid when the soils are drained. During the growing season, reducing conditions lead to the formation of hydrogen sulphide which is very toxic to plant roots. Since the conductivity is determined on the air-dried samples, a considerable proportion of the sulphur will be oxidised to sulphuric acid and soluble sulphates. The conductivity measures these together with any soluble chlorides present. Where the specific conductivity is higher than 200 (mhos $\times 10^{-6}$), soluble sulphates and chlorides are determined on the samples.

A Description of the Major Soil Groups.

PEATS AND MUCKS.

Occurrence.

In its pure form, peat consists of reddish-brown, loose, organic material composed of partly decayed leaves, timber and roots. The greater proportion of the Trans-Perak peat is forest peat, built up mainly from the earlier or existing swamp forest mixed with some sedges and fern debris from the undergrowth of this type of forest.

It is only in fairly recent years that work in Indonesia has elucidated some of the properties of tropical peat. Before that, there was a widespread belief that peat could only form in areas with a fairly low temperature, thus slowing down the decomposition of the organic remains. However, it is now obvious from observations in the tropics, that there is peat in abundance and that the main criterion for its formation is water-logged conditions.

In the Trans-Perak area, the river would appear to have meandered over the area while flowing in a general north-south direction and to have built up a series of levees, especially in the south-central part of the area. In the low-lying, water-logged hollows between these levees, peat has formed. Thus the general pattern of the soils in this area is one of alternating strips of peat and mineral soils.

When the peat is shallow, the roots of plants growing on it can reach the underlying mineral soils and bring up plant nutrients from depth. As the peat gets deeper, plant roots are no longer able to reach the underlying material and have to rely solely on the surface peat for their nutrition. This is low in nutrients and the material returned in the form of plant debris is also poor. The spongy nature of the peat enables it to hold sufficient water to promote anaerobic conditions and so continue to build up until the surface is dome-shaped.

In the central and north-western parts of the area, much larger and deeper areas of peat are found, and these appear to have formed in large depressions, which may have resulted from the sea building up the land to the west.

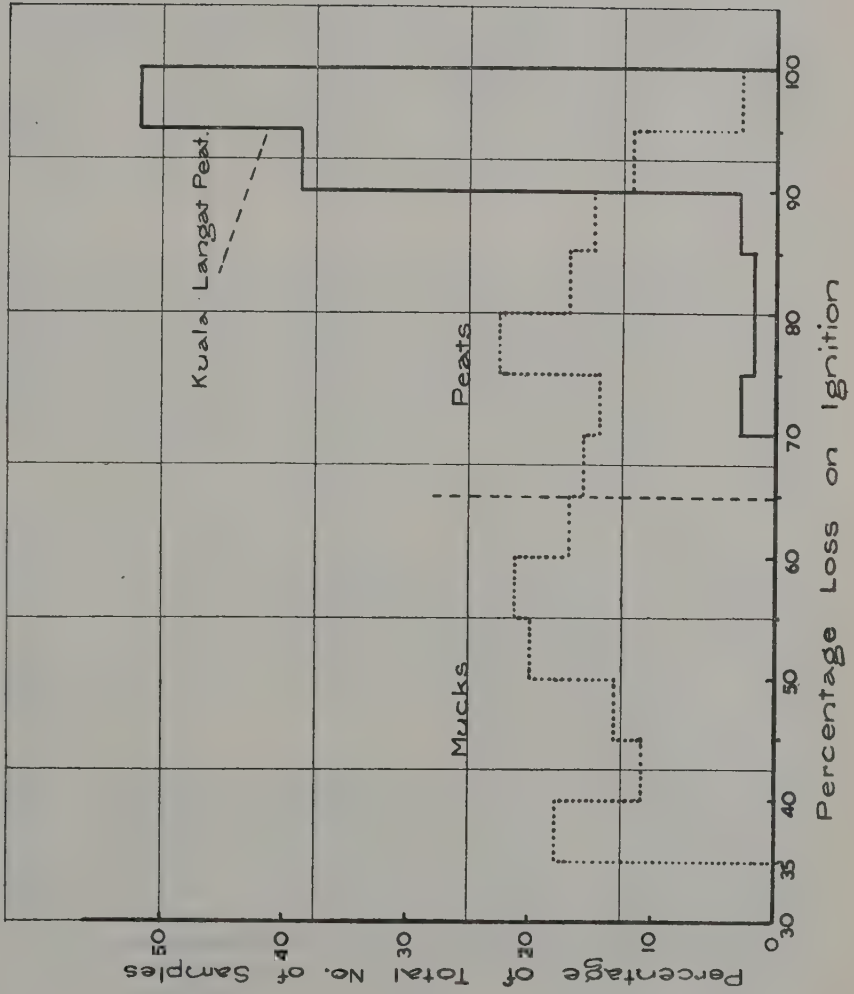
Composition.

(i) Loss on Ignition.

Since peats and mucks are separated entirely on the basis of their loss on ignition, there is a continuous distribution of soils from those with a low loss on ignition to those with practically no mineral matter. To illustrate this the results from the Trans-Perak area are shown in Fig. 1.

This figure shows that only 15 per cent of all the samples of organic soils have a loss on ignition greater than 90 per cent, thus indicating that most of the organic soils of the Trans-Perak area could more properly be termed "muds". This refers to their method of deposition

Figure I.
Distribution of Values for Loss on Ignition.



and not to their composition. The organic debris is deposited under conditions where there is water flowing into the area from streams, etc. The water carries a certain amount of silt which becomes mixed with the organic debris, so forming a peat with a high mineral content. On the other hand, there are some areas of peat in Malaya, e.g. Kuala Langat, Selangor, where the peat appears to closely resemble the raised bog peat found in Europe. In Kuala Langat, where the peat is apparently older and the surface dome-shaped, the only source of water is rainfall, and thus no mineral matter is added. In Fig. I, it will be seen that 92 per cent of the samples give less than 10 per cent ash, and are consequently true peats of much poorer nutritive values than the "muds" of the Trans-Perak area.

(ii) *Acidity.*

All Malayan peats are acid, some of them extremely so. There are no peats corresponding to those of the Fens in England. However, comparison of their pH with that of alluvial clays found in the same area shows that they are not much more acid than the clays. The results are plotted in Fig. II, which shows that a greater proportion of the samples have a pH between 3.7 and 4.9. Compared with peat from other parts of Malaya, the Trans-Perak peats and mucks are slightly less acid.

(iii) *Chemical Characteristics.*

Readily Soluble Nutrients. The readily soluble phosphorus and potassium were determined. The figures for phosphorus show that there is no great difference between the values for peats and mucks and those for clays. The results are shown in Fig. III.

It can be seen that the phosphorus values for the peats are a little higher than those for the clays. Phosphorus is not usually a limiting nutrient for crops, other than padi, on peat, at least as far as experiments in Malaya have shown.

It is the potassium results which show the greatest differences. Some of the results for readily soluble potassium in peat give values of over 1,000 p.p.m., a figure several times that usually found in mineral soils. The reason for these high values is unknown and is certainly surprising because a number of crops, when grown on peat, are known to respond to potash. Whatever the reason, there is a general correlation between loss on ignition and readily soluble potassium.

The distribution of the results for potassium values is plotted in Fig. IV.

(iv) *Conductivity.*

The peats in the area have generally quite high specific conductivity, of the order of 300 to 400 (mhos $\times 10^{-6}$), but they contain little soluble salts and are therefore unlikely to have toxic properties.

Figure II.
Distribution of pH Values for Peats, Mucks and Clays.

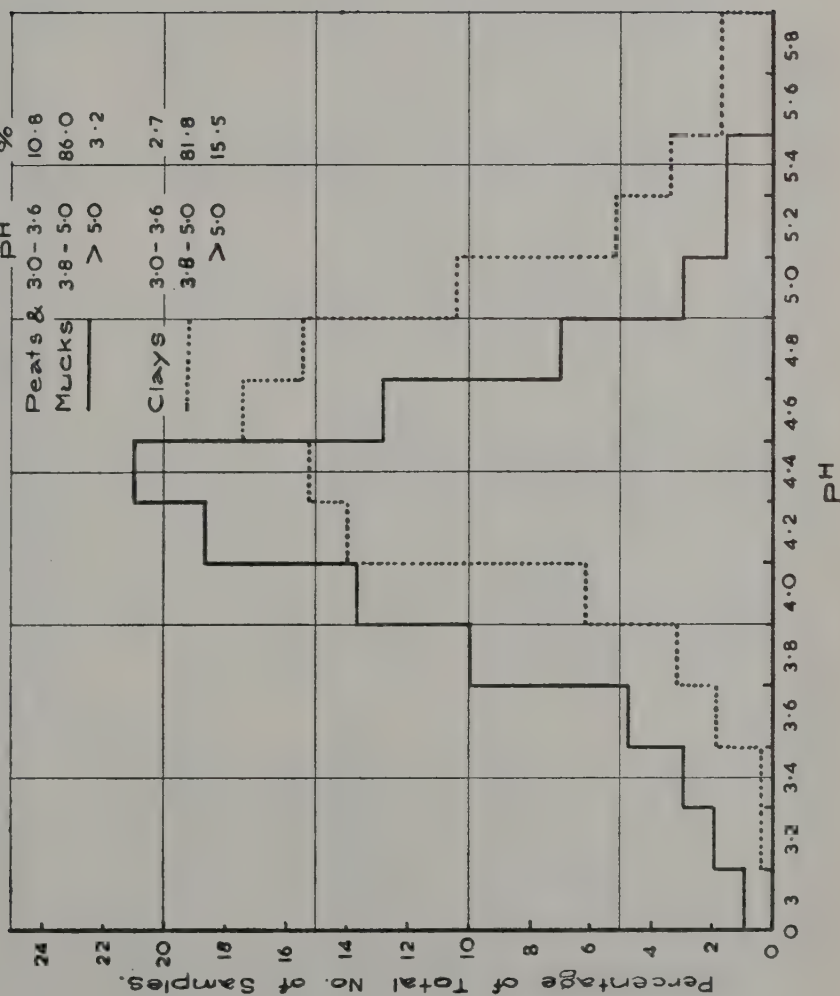


Figure III

Distribution of Readily Soluble Phosphorus
Values for Peats, Mucks and Clays.

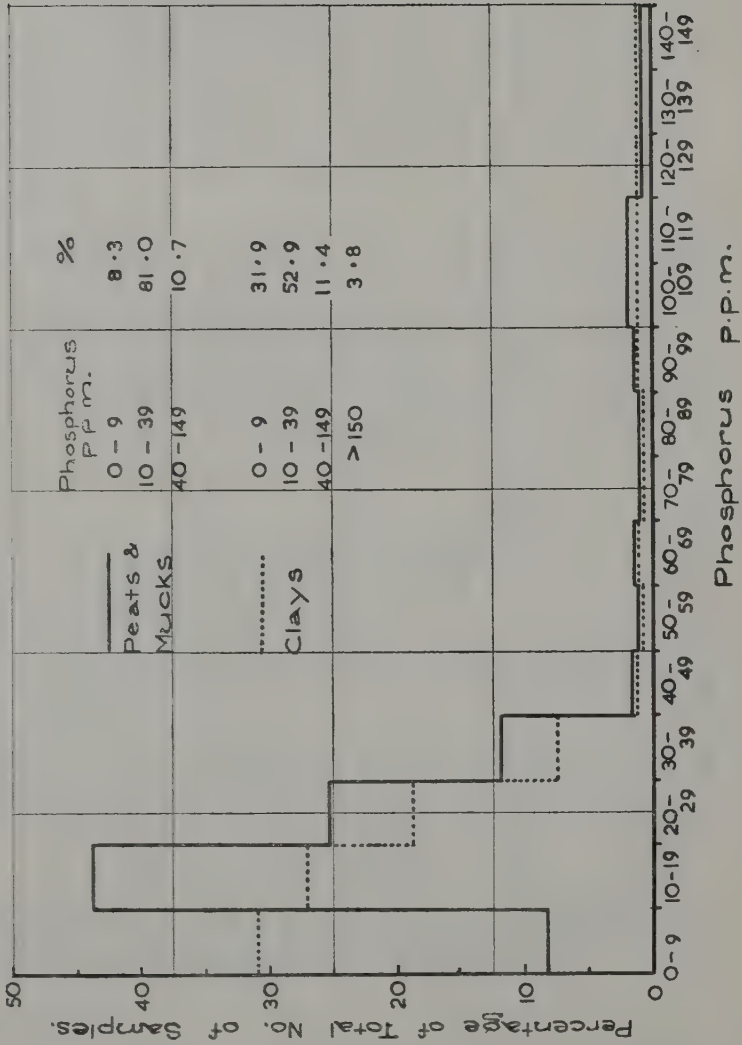
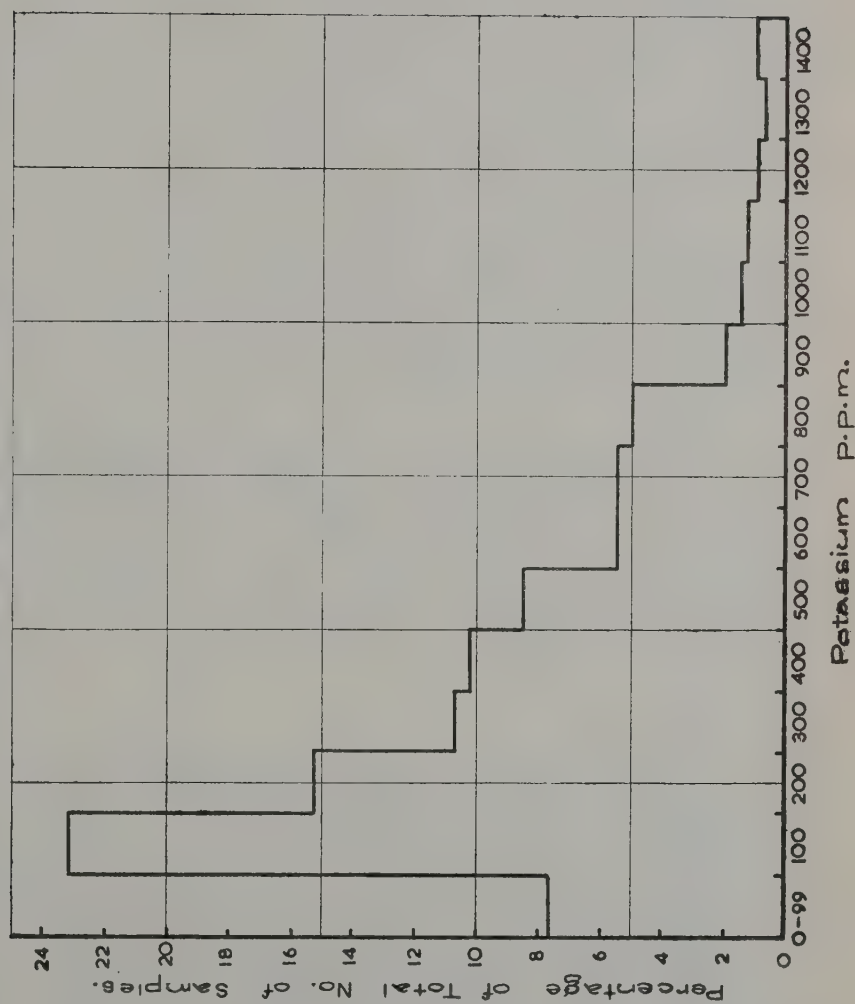


Figure IV.
Distribution of Readily Soluble Potassium
Values for Peats and Mucks.



MINERAL SOILS.

Under this heading, all soils which are not peat or muck are included. The mineral soils in the area are recent alluvium and thus have no properly developed profile. The factors influencing the nature of alluvial soils are the parent material and the manner under which they were deposited. In the Trans-Perak area, the alluvium has been derived from many sources and is inextricably mixed. As regards manner of depositions, it is probable that the greater part of it was laid down under fresh-water conditions, i.e. river or inland alluvium. From the fertility point of view this is quite important because marine or coastal alluvium is generally richer in plant nutrients, especially bases, i.e. sodium, potassium, magnesium.

As pointed out earlier, classifying these mineral soils by profile examination is impossible, so that textural classification based on the results of mechanical analyses had to be adopted. It is realised that this type of classification can be severely criticised on the grounds that arbitrary lines have been drawn on a classification based solely on laboratory examination. While this is accepted, reference to the literature has not revealed any better methods which could be applied to such large, water-logged areas.

Distribution curves for the percentages of silt and clay for topsoil and subsoil are shown in Fig. V. The curves show a similar distribution of clay and silt fractions in both top and subsoil, thus illustrating that there is little differentiation between the two horizons. This would indicate that there is no distinct layering effect in the laying down of these alluvial soils, at least in the top 18 in. Therefore, in preparing the soil map showing the distribution of the textural types, the values for the topsoil only have been taken.

Composition.

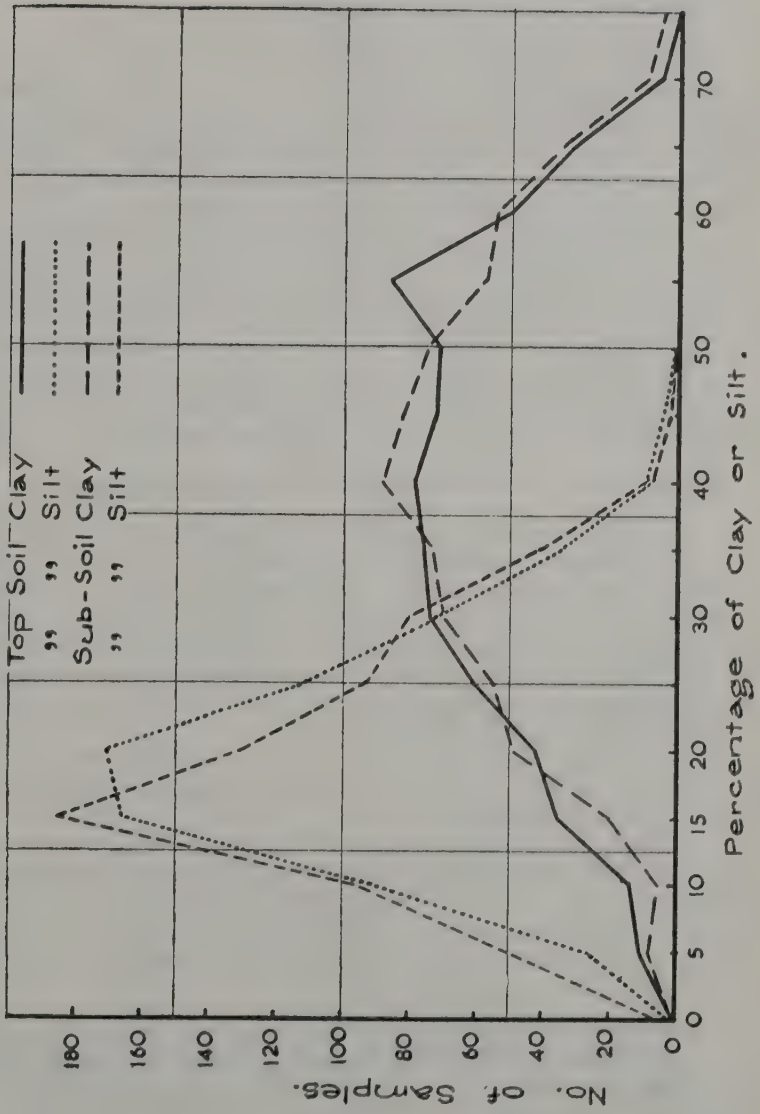
(i) Texture.

The greater portion of the soils in the area fall into the class of clays; there are also some areas with clay loams, sandy clay loams, coarse sandy loams and loamy sands. Most of the soils in the southern part of the area are clays, as are also the soils in the Raja Hitam Forest Reserve. Clay loams also appear in the vicinity of these clays. In the north there is one area of coarse, sandy soil to the west of the peats and mucks. This belt of sandy material is possibly an old bed of the Perak River. There is also an area of poor, sandy soil, presumably of marine origin, in the region around Lekir. On the whole, it can be said that quite a high proportion of the mineral soils have a texture suitable for padi.

(ii) Acidity.

The pH values of the clays have been examined in the same manner as those of the peats, and the results are expressed graphically in Fig. II. It will be seen that the clays have a slightly higher average value

Figure V.
Distribution of Clay and Silt Fractions
for Top and Subsoil.



than the peats. Only 7.2 per cent of the samples are below 4.0, and 83.0 per cent fall between 4.1 and 5.3. This is a good illustration of just how acid alluvial soils can be, and is an average range for this type of soil in Malaya.

(iii) Readily Soluble Phosphorus and Potassium.

These were determined in the same manner as those for peat. The results for phosphorus are illustrated in Fig. III. It will be seen that a somewhat higher percentage of the mineral soil samples had very low phosphorus values as compared with the peats. The greater majority of the samples had values below 40 p.p.m. phosphorus.

The distribution of potassium values is shown in Fig. VI. It will be seen that the values are, in general, much lower than those for the peats and mucks, although they have a wide variation. It appears that the samples from areas which have been under marine influence (as shown by higher salt contents) are also higher in potassium.

As pointed out earlier, values for readily soluble potassium and phosphorus are difficult to interpret and should not be considered absolute values, but they are of some use for comparative purposes.

(iv) Conductivity and Water Soluble Chlorides and Sulphates.

Conductivity measurements were carried out in order to check on any excess of soluble salts, particularly chlorides and sulphates. Where the specific conductivity was greater than 200 (mhos $\times 10^{-6}$), determination of water soluble sulphates and chlorides was carried out. It should be noted that the conductivity measurements and determination of soluble salts were carried out on samples which had been dried; consequently there would be opportunity for most or all of the oxidisable sulphur to be changed to sulphates.

Only a very small proportion of the samples contained any quantity of sulphates, in fact only 18 of the 3,300 samples examined had more than 0.1 per cent sulphate.

Many more samples contained chlorides. The great majority of the samples had less than 0.3 per cent. In Fig. VII, the percentage water soluble chlorides has been plotted against the specific conductivity and this shows that there is a correlation between the two. The amount of chlorides in these soils would not be considered harmful for padi.

Development Potentialities of the Area.

It is usual for the soil surveyor to include some suggestions for developing the area he has surveyed and to give an appreciation of its agricultural potentialities. The position is complicated in the present survey, however, by the fact that the major object is irrigation, so that levels are equally as important as soils. Naturally enough, if the levels are unsuited to an irrigation scheme, the scheme cannot be considered, regardless of whether the soils are suitable or not.

Figure VI.

Distribution of Potassium Values for Clays.

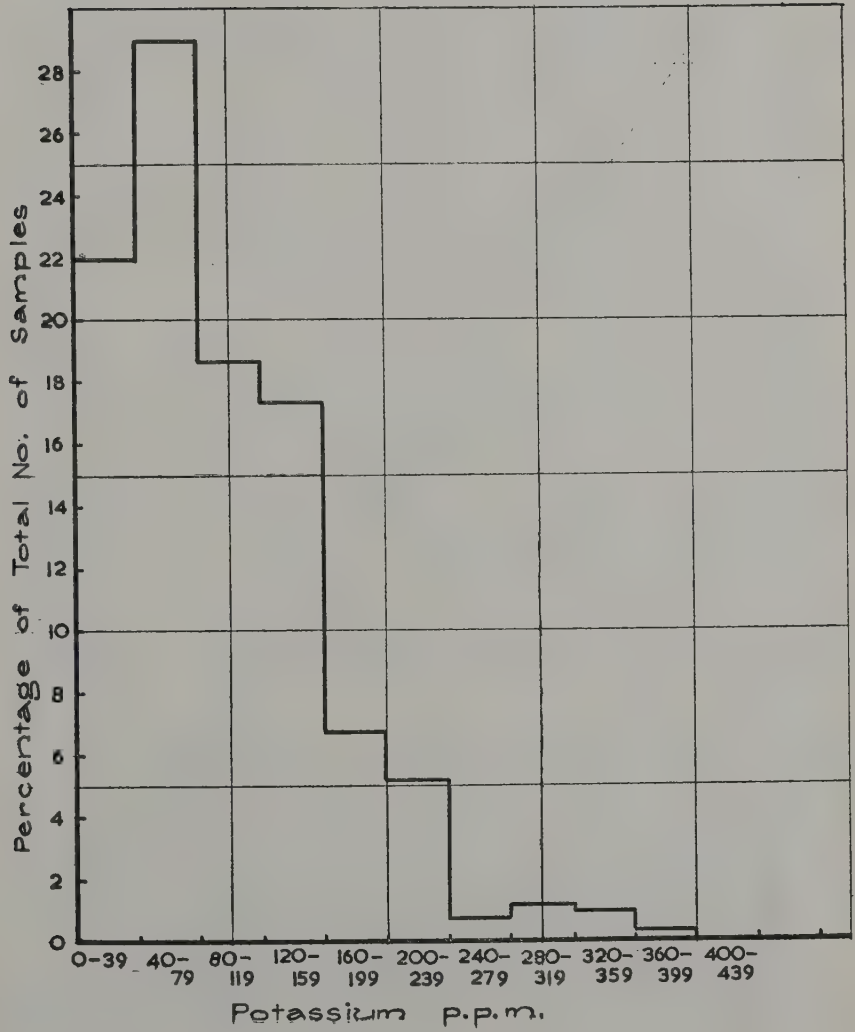
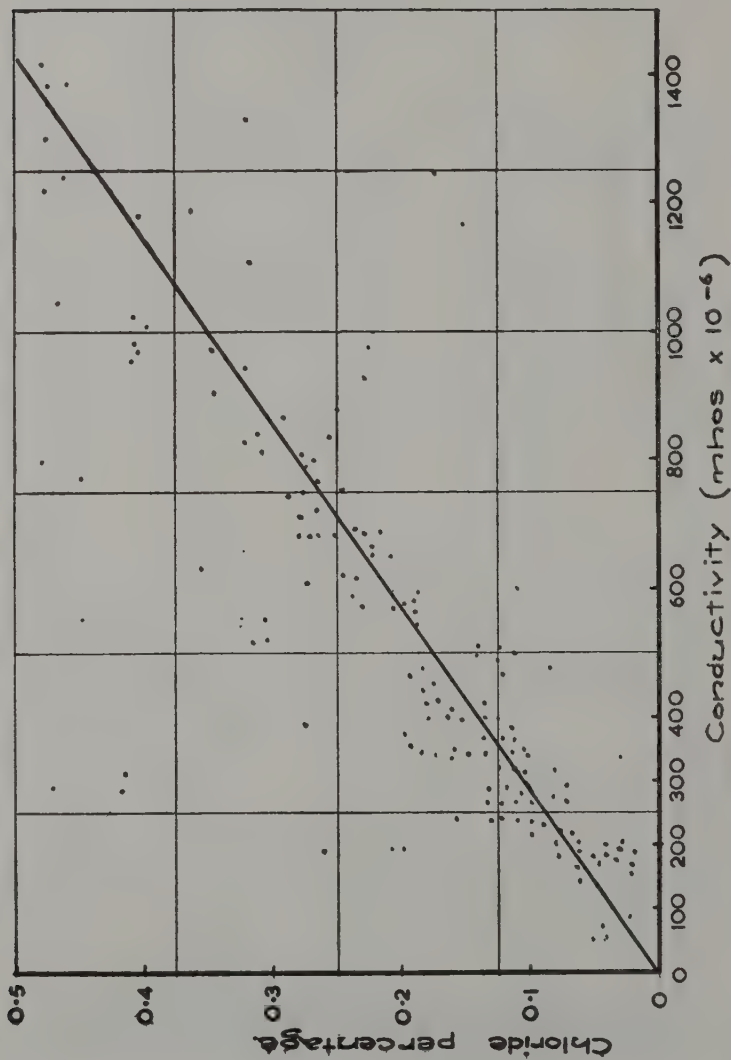


Figure VII.

Correlation between Chloride Concentration and Conductivity.



DEVELOPMENT OF THE NON-PEATY SOILS.

Apart from delineating the peat in the area and giving an indication of its depth, we should, from the survey, be able to give some suggestions on the value of the mineral soils for padi growing. Table II shows that there is 71,000 acres of peat and muck out of a total area of approximately 200,000 acres, thus leaving 129,000 acres of mineral soil. If this were all in one block it would not be difficult to devise a scheme to cover it; but it is split up, especially in the southern part of the area, where there appear to be strips of peat alternating with clay. Some of these strips are quite shallow and the peat will disappear through time. The most serious obstacle to development would appear to be the large block of deep peat which occurs right in the centre of the main area. Thus, from the broad point of view of an irrigation scheme, the spasmodic nature of the occurrence of mineral soils will present difficulty.

We can next consider the value of the mineral soils from a specific point of view, i.e. padi cultivation. It should be pointed out here that we do not have nearly enough information on the alluvial soils of Malaya to make a full evaluation of their potentialities on the basis of laboratory analyses. However, the knowledge we do have can be used to compare them with other soils, the value of which, for padi cultivation, is known.

Clay soils, provided they do not contain any toxic substances, do, by and large, make reasonable padi soils. As pointed out earlier, the fact that they contain a high proportion of fine fractions may not be the sole reason for their good reputation. On the other hand, examples are known where sandy soils, even those containing quite a considerable proportion of coarse fractions, e.g. coarse sandy loams and gravelly loams, give good yields. In their case, a uniform and constant irrigation supply appears essential, and this is often difficult to attain because the very nature of the origin of these sandy soils leads to uneven levels. Thus a sandy soil should not be condemned out of hand as being unsuitable for padi.

The greater proportion of the soils in the area are clays and clay loams, and from a textural point of view are suitable for padi. The inherent fertility of these soils, i.e. their potential padi yield, cannot, in the present state of our knowledge, be accurately defined. The indications are that, in general, the mineral soils of the Trans-Perak area are not quite as good as those of the good coastal areas of Tanjong Karang, Selangor, or Krian, Perak. This view is based on their morphology and on the study of their nutrient status.

In the south-central portion of the area, the sequence of mineral soil and peat bring to mind some of the conditions in Sungei Manik, South Perak, where the alluvial material is mostly river-borne, and where the soil is not particularly fertile.

There is an area in the northern part of Trans-Perak with a one- to two-foot layer of clay over peat or muck. How padi will grow on this is not quite certain, though it should be successful. The objection to this

type of formation, i.e. clay over peat, has been that, in certain areas, e.g. Paya Besar, Pahang, and Tanjong Minyak, Malacca, it gives rise to very sulphurous soils. In the Trans-Perak area the same factors do not appear to have been present, and no high concentrations of sulphates were noted. Thus it can be said that, as far as can be seen from the present survey, the soils are generally free of potentially toxic materials.

Considering the scheme as a whole, the most promising areas for padi, from a soils point of view, are the areas in the south-west, the strip of clay soils along the river bank, and the Raja Hitam Forest Reserve.

DEVELOPMENT OF THE PEAT.

There are two major factors which have to be considered when the agricultural potentialities of peat are being discussed. The first, and most important factor, is its depth. If the peat is shallow, not only can the roots of plants reach the underlying clay but also the peat will disappear in time with cultivation. There are no records of really critical measurements of the rate of decrease in depth of peats, though Van Wijk (1) states that in the tropics a shrinkage rate of 20 in. per year is not unusual. There is no doubt that the original levels of deep, wet peat will be reduced two to three feet by shrinkage consequent on the drainage on opening up, but it has been noted that further reduction is fairly slow unless burning is carried out. Another reason for large shrinkage in developed areas is the removal of timber, a never-ending task in areas of deep peat as each removal leads to more shrinkage and further exposures. It has been suggested that up to five feet of peat will disappear within a fairly short time, but this has not been confirmed by experience in Malaya.

The second important factor in connection with cultivation of peats is the mineral content; those with the higher ash content will in general contain more plant nutrients.

As regards the value of peat and muck for agriculture, experience to-date indicates that these soils, even when shallow, are not really suitable for padi. At Tanjong Karang, there is a layer of two to three inches of muck which the cultivators are very keen on conserving, but where the organic layer is deeper, padi does not do so well. It appears to grow quite well vegetatively, but yields are low. This would indicate that even shallow peats could only be regarded as third-class padi land. As regards the deeper peats, there is little doubt that in the present state of our knowledge, padi growing on them is uneconomic and should not be considered.

An initial depth of $3\frac{1}{2}$ to 4 ft. of wet peat should be considered as the maximum depth for development of an area for padi cultivation, and deeper peats and mucks should be reserved for other crops.

The acreages of peat and muck, amounting to about 35 per cent of the total acreage, have been estimated from the soil map and are shown in Table II.

Table II.

The Trans-Perak Swamp.

Depth of Peat and Mucks	Total Area
ft.	acres.
Over 10	24,000
5 to 10	23,000
2 to 5	16,000
under 2	8,000
Total	71,000

It is unfortunate from the point of view of a padi irrigation scheme that the central portion of the area contains a large amount of deep peat. What to do with this area of peat is certainly one of the big problems confronting those planning the development of the area as a whole. The alternatives seem to be to leave it in jungle, or, if it can be kept drained during the irrigation seasons, consider development for crops other than padi. Where the peat is deep, say over 5 ft., pineapples would be the obvious crop, but where it is less than 5 ft. at present, and subsequently nearer 3 ft. when drained, tree crops, e.g. coffee and oil palm, might be considered.

How to develop the drainage of the area of peats while they are more or less surrounded by irrigated padi land is of course a big problem. In some areas of tropical peats the surface is dome-shaped, and in these drainage would be easier; in the Trans-Perak area, however, although detailed levels of all lines are not in the authors' possession, the levels of lines 8, 11 and 17 indicate that these peats are not raised in the centre of the area, thus drainage may be more difficult.

As surveys of Malaya's larger coastal swamps progress, primarily with a view to their development for padi cultivation, the evidence is accumulating that peat occurs, unfortunately in considerable extent and depth, within a few miles of the coast in nearly every area. It is feared that the Trans-Perak area is an example of what will be found when other similar, large areas are examined in detail. Present indications are that it may never be economic or even possible to grow good crops of padi on peat, and it may be necessary to accept the fact that the widespread occurrence of deep peat will severely reduce the area of potential padi land still under jungle. A solution of the problem of economic utilization of deep peat may have very wide application.

References.

- (1) Van Wijk, C. L. (1951): "Soil Survey of Tidal Swamps of South Borneo in Connection with the Agricultural Possibilities." Contributions of the General Agricultural Research Station, Bogor, Indonesia, No. 123.
- (2) "Soil Survey Manual". Agriculture Hand-Book No. 18 (1951). United States Department of Agriculture.

Acknowledgements.

We wish to acknowledge the part played in the survey by the State Agricultural Officer, Perak, and his staff, without whose help the original samples could not have been taken.

We also wish to thank the Consultant Engineers, Sir Bruce White, Wolfe Barry and Partners, whose staff were responsible for taking a very large proportion of the samples.

Acknowledgement is made of the help given by Mr. R. B. Jagoe, Chief Research Officer of the Department of Agriculture.

A STUDY OF SOME CULTURAL EFFECTS ON PROTEIN CONTENT OF GUINEA GRASS.

BY

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Introduction.

There can be no doubt that one of the means of diversifying agriculture in Malaya is the development of a sound livestock industry. Progress towards this end will gradually reduce present livestock imports until the country becomes self-sufficient. It also means that livestock will become an integral component of the permanent system of agriculture, and will play their full part in increasing and maintaining soil fertility.

Shortage of good grazing lands, an initial hurdle to the development of a sound livestock industry in this country, may be overcome by the cultivation of tropical fodder grasses. This system has been adopted successfully in a number of tropical countries where many such grasses have given very high yields. A few of these grasses have already been grown successfully in Malaya. However, soil of low fertility, such as that found at the Federal Experiment Station, Serdang, Selangor, has failed to give yields that are comparable with those obtained in other tropical regions.

Guinea grass, *Panicum maximum*, is one of the most promising of the imported species of fodder grasses. Yields from 16 (1) to 20 (2) tons per acre per year were obtained from experiments carried out before the war. It was also shown then that an increase in yield was possible through the use of commercial fertilisers. In fodder grass trials carried out since the war, emphasis has been laid on the effect, on yield of cut grass, of varying the quantity and composition of the fertiliser dressing applied. These trials showed that yields, hitherto unexpected, were obtained through the judicious use of commercial fertilisers.

The Nutritional Value of Fodder Grass.

The ideal fodder crop, other things being equal, is one that gives a high yield of fresh material per acre per year and, in addition, a large part of the protein requirements of the animals, since protein is the most expensive item of the feed. Gunn Lay Teik (3) has shown that, as with other species, the digestible protein content of Guinea grass varies with age; it is higher when the grass is young, the values ranging from 3.8 per cent at one week old to 1.3 per cent at six weeks old. He also quotes the protein content of Guinea grass at 2.1 per cent as compared with the 3.0 per cent of average European meadow grass. It is obvious therefore that Guinea grass cut at the Serdang harvesting interval of six weeks is low in protein, but on the other hand the

yield has been shown to be high and the grass does not appear to suffer or lose its vigour as much and as rapidly as it does under more frequent cutting.

The use of commercial fertilisers has been shown to effect an increase in the yield of cut grass, and it was to be expected that the nutritional value, in terms of protein content, would also be influenced to a certain extent by this manuring.

Object.

It is intended in this article to examine the data from the chemical analyses of grass from two manurial trials carried out at the Federal Experiment Station, Serdang, and to discover the effects of manuring, with varying quantities of commercial fertilisers, and also the effect of different frequencies of application of a uniform, annual manurial dressing on the protein content of Guinea grass.

Sources of Information.

The sources of information which form the basis of this study are two experiments on Guinea grass carried out at Serdang. These experiments are:

- I. Massive dressing of nitrogenous fertiliser—Experiment No. F.E.S.S. 78.
- II. Times of application of commercial fertilisers—Experiment No. F.E.S.S. 67.

These experiments have already been reported by Henderson (4). A brief resume of them is, however, appropriate to this study.

TRIAL I.

Trial I was a six randomized-block layout, each block with six plots for five application rates, namely 2, 4, 6, 8 and 10 cwt. of sulphate of ammonia per acre per year, and a control. Manure was applied at quarterly intervals, that is four applications per year. The trial was started in 1949 and concluded in 1953.

Basal manuring constituents are given in Table I.

Table I.
Trial No. F.E.S.S. 78.
Basal Manuring.
(cwt. per acre per year)

Period	Rock Phosphate	Basic Slag	Muriate of Potash
Nov., 1949, to Nov., 1950	2½	Nil	2½
Nov., 1950, to Nov., 1951	Nil	Nil	6
Nov., 1951 to Nov., 1952	Nil	1½	5½
Nov., 1952, to Nov., 1953	Nil	Nil	2

Henderson (4), using Stevens' (5) asymptotic regression method, found that there was no significant ($P=0.05$) deviation of the expected yield curve from the recorded curve, and he concluded that the response to 2 cwt. of sulphate of ammonia was progressively and consistently reduced with increase of dressings from 0 to 8 cwt. of fertiliser per acre per year.

TRIAL II.

Trial II was established in 1949 to investigate the effect of frequencies of manuring on the yield of grass. The treatments of the trial, distributed at random in each of five blocks, comprised a uniform, annual, manurial dressing applied at monthly, two-monthly, four-monthly and six-monthly intervals, that is, 12, six, three and two applications per year. Fertiliser composition was varied from time to time, and these variations are shown in Table II.

Table II.
Trial No. F.E.S.S. 67.
Composition of Fertiliser.
(cwt. per acre per year)

Period	Sulphate of Ammonia	Super- phosphate	Muriate of Potash
Sept., 1949, to Aug., 1950.	3	2	2
Sept., 1950, to Aug., 1951.	6	Nil	4
Dec., 1951, to Dec., 1953.	3	1*	3

* Double superphosphate

Henderson (4) found that there was no significant difference in yields of grass between the treatments during the first two-year period of trial or during the second two-year period. During the latter period, there was a fairly large reduction in yield, which was probably caused by the reduction in quantities of nitrogen and potash due to a change in the manurial programme.

Cutting and Sampling.

In Trial I, different intervals of cutting were employed during the life of the experiment, and these are shown in Table III.

During the first two years of Trial II, grass was cut at monthly intervals. From the beginning of the third year until the conclusion of the trial, cutting was done at intervals of six weeks.

Grass was cut by hand, with the use of ordinary sickles, between 7 and 9.30 a.m. Individual plots were harvested after the guard rows

and discards had been cut and removed. The cut grass from each plot was tied into bundles to facilitate weighing, after which samples were taken for analysis. This was done by pulling out small handfuls of grass from all the bundles which represented the yield of each plot. Plot samples were tied, labelled and taken to the laboratory for chemical analysis immediately after sampling. Both sampling and chemical analysis of grass were carried out by the staff of the Chemistry Division.

Table III.
Trial No. F.E.S.S. 78.
Cutting Intervals.

Period	Cutting Programme
Jan. to May, 1950	Each plot was divided into three sub-plots for three different intervals of cutting, namely intervals of three, six and nine weeks.
July, 1950, to Dec., 1951	Cutting at monthly intervals.
Jan., 1952, onward	Cutting at intervals of six weeks.

Analysis.

In Trial I, grass samples were analysed from all cuts taken between the 27th March, 1950, and the 2nd December, 1952. The types of analysis carried out are summarized in Table IV.

Table IV.
Trial No. F.E.S.S. 78.
Types of Analysis.

Period	Analysis
I. 27th March to 5th May, 1950 (2 cuts)	Moisture and crude protein
II. 23rd January to 21st April, 1951 (4 cuts)	Moisture and crude protein
III. 22nd May to 22nd November, 1951 (7 cuts)	Moisture, crude protein, CaO and ash
IV. 22nd December, 1951, to 1st March, 1952 (3 cuts)	Moisture, crude protein, CaO ash and K ₂ O
V. 17th April to 2nd December, 1952 (6 cuts)	Moisture and crude protein

On the 27th March, 1950, grass from two sub-treatments of cutting intervals (three and six weeks) was harvested. Samples from manurial treatments were split into the two cutting sub-treatments. Twelve samples (sub-samples) were collected and analysed for this particular cut. At the next cutting (5th May, 1950) the three sub-treatments were harvested and samples from each manurial treatment were split into three sub-samples for the three sub-treatments. The number of samples (sub-samples) analysed was 18. After this, when grass was cut at one cutting interval, samples from all plots were analysed.

In contrast with Trial I, chemical analysis of grass from Trial II was not started until later in its history, that is, beginning from the commencement of its third year, and was continued through the fourth year. Analysis was started on the 3rd March, 1952, and was stopped after the 1st December, 1953. During this period, grass was cut at intervals of six weeks and a uniform manurial composition was used. Samples from all plots, 20 samples in all, were collected and analysed at every cut for moisture and crude protein.

Effect of Nitrogen on Protein Content.

The statistical examination of the effect of interaction between quantities of sulphate of ammonia and age of grass on protein content will not be considered because of insufficient data.

Table V shows the mean crude protein content calculated from analyses of 20 harvests over a period of two years. Twelve of these were at monthly, and eight were at six-weekly intervals. Protein yield of each plot was calculated for all the intervals; this and the plot yields of grass were totalled and, from these, protein percentages were calculated and are shown in Graph I plotted against the amounts of sulphate of ammonia used. The curve shows a small but fairly steady increase in protein content with successive additions of 2 cwt. of sulphate of ammonia up to 10 cwt. per acre per year.

Table V.

Trial No. F.E.S.S. 78.

Average Crude Protein Content of Guinea Grass.

(per cent)

Sulphate of ammonia (cwt. per acre per year)	0	2	4	6	8	10	Mean	
Mean protein content	2.021	2.117	2.191	2.306	2.460	2.501	2.266	SE 0.06048 DF 25

Graph I also shows the regression graph of protein content of Guinea grass on the quantities of sulphate of ammonia. The regression coefficient (0.050681 per cent protein per cwt. of sulphate of ammonia per acre per year) is significant at a point less than 0.001 per cent, proving that increasing the sulphate of ammonia by 2 cwt. per acre per year up to 10 cwt. per acre per year produces an increase in the protein content of grass.

Table VI.
Trial No. F.E.S.S. 78.
Protein Yield.
Mean of Six Plots.
(lb.)

Sulphate of ammonia (cwt. per acre per year)	0	2	4	6	8	10	Mean	
Mean protein yield	15.13	22.26	25.23	28.84	30.71	31.59	25.63	SE 2.5375 DF 25

Table VI and Graph II show mean protein yields in lb. per plot. The analysis of variance of protein yield showed that differences between treatments attained significance at a point less than 0.001 per cent. Deviation from regression, calculated by Stevens' (5) asymptotic regression, was not significant. The conclusion is drawn that increasing the amount of sulphate of ammonia, up to 10 cwt. per acre, raised the protein yield of Guinea grass.

Effect of Frequency of Manuring on Protein Content.

Protein percentages for the treatments were calculated and analysed in the same manner as described previously. The results showed that there was no significant difference between the treatments ($P = 0.05$). The mean protein percentage is shown in Table VII.

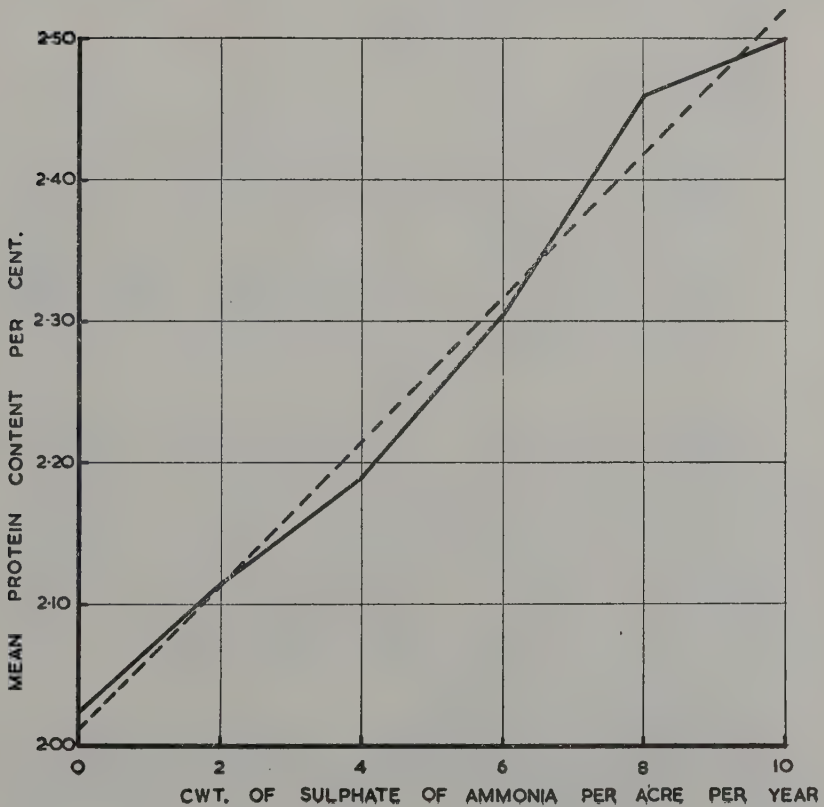
Table VII.
Trial No. F.E.S.S. 67.
Mean Protein.
(per cent)

Manurial frequency	(A) 2-monthly	(B) Monthly	(C) 4-monthly	(D) 6-monthly	General Mean	
Mean protein	1.910	1.928	1.968	1.808	1.904	SE = .092865 DF = 12

(In all treatments an equal quantity of fertiliser is applied each year).

GRAPH I
TRIAL No. FESS. 78

Mean Protein Content (—) in Relation to Amounts of Sulphate of Ammonia and Regression Graph (---) of Protein Content on the Quantities of Sulphate of Ammonia.



Graph III shows the protein yields from the treatments throughout the period when analysis was carried out. In general, for the monthly, two-monthly and four-monthly applications, protein yield started at a high level but dropped off suddenly after this initial rise and remained low during the rest of the time. There was a tendency however for the protein yield to increase during this latter period. This tendency was most marked in the least frequent of the three intervals of manuring. In the six-monthly dressing, the level of protein yield was much lower than that of the first three frequencies, but the yield was markedly increased at cuts immediately after manurial dressing (which took place approximately six weeks earlier) and dropped sharply at the following cut. It remained at a low level until the cut following the next manurial dressing, six months later, when it rose again.

Conclusions.

From the results of analyses of these two trials, the following conclusions are drawn:—

- (a) protein content of Guinea grass, within the limits of Trial I (Trial No. F.E.S.S. 78), is increased with successive increments of 2 cwt. of sulphate of ammonia per acre per year up to 10 cwt. per acre per year, and
- (b) under the conditions of Trial II (Trial No. F.E.S.S. 67), it was shown that there was no difference in protein content of grass when a uniform, annual manurial dressing is applied at the four different frequencies under trial.

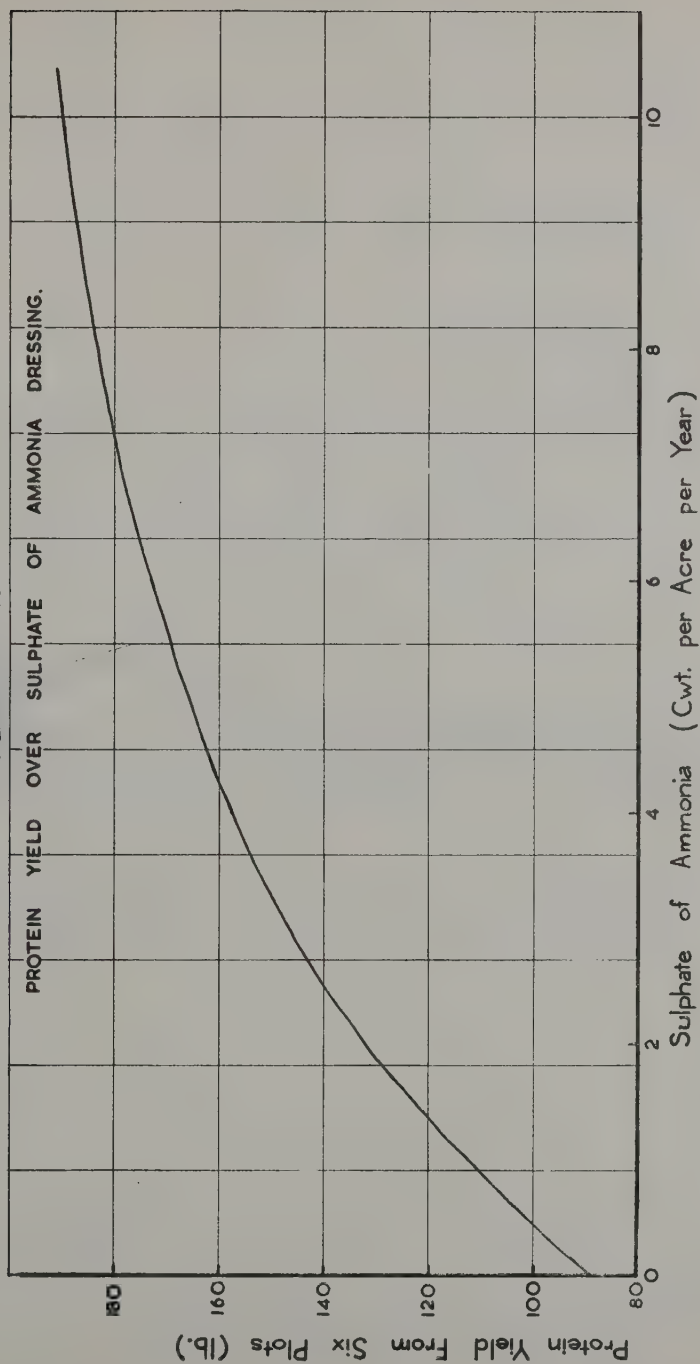
Discussion.

In earlier manurial trials (1), carried out on both heavy and light soils with complex manurial dressings containing variable amounts of phosphate and potash but with a more or less uniform amount of nitrogen, it was found that for both short (two and three weeks) and long (four, five and six weeks) cutting intervals, manurial treatments had very little effect on the protein content of grass. The protein level was high, however, namely 14.5 to 18.0 per cent (dry basis) on heavy soils and 16.3 to 17.4 per cent on light soils for the short cutting intervals. For the long cutting intervals, protein content varied from 9.4 (lowest, at six-weekly cuttings on heavy soil) to 12.4 per cent (at four-weekly intervals on light soil).

It is obvious that the high level of protein was principally due to the age of the grass, and any variation in the protein content between the manurial treatments cannot be expected since the total amount of nitrogen in the different dressings was nearly uniform. Furthermore, it was recorded from the same trials that protein content tended to decrease with an increase in the interval of cutting.

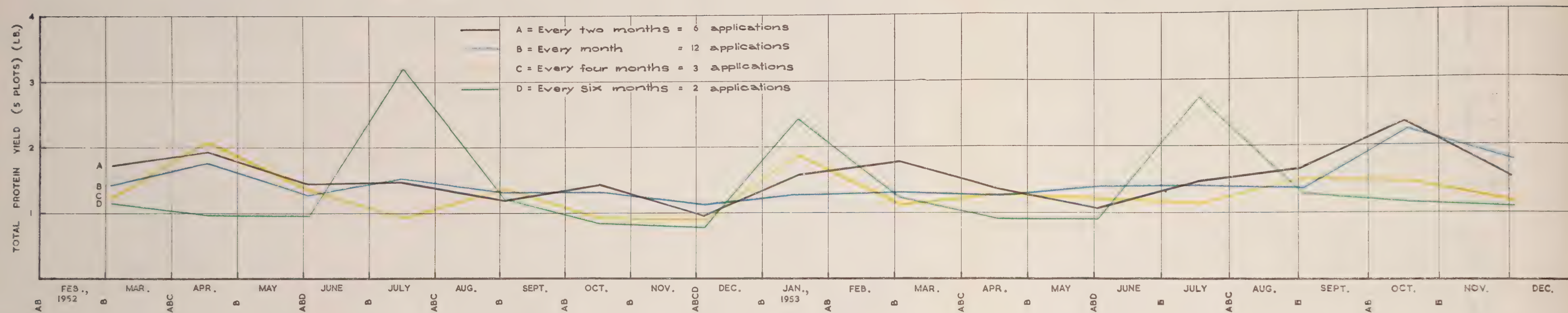
The results of Trial I (Trial No. F.E.S.S. 78) indicated that manuring with increasing amounts of sulphate of ammonia did produce an increase in protein content. This can be expected, since the amount

GRAPH II
TRIAL No. FESS. 78



GRAPH III
TRIAL No. FESS. 67

Guinea Gross Yield of Protein (lb.) from Five Plots Shown in Relation to Times of Manurial Dressing.



of nitrogen was increased at a constant rate from 0 to 235 lb. per acre per year. The generally lower level of protein content of grass compared with that reported earlier can only be explained by the age of the grass.

Frequencies of application of a uniform, annual manurial dressing were shown not to affect the protein content of the grass. This may be explained by the fact that a uniform amount of 70.6 lb. of nitrogen per acre per year, on being applied at different frequencies, had to be given in small doses. The most frequent application resulted in very small doses whereas the least frequent treatment resulted in grass receiving manure only twice a year.

One general conclusion that can be made from the results of the present trials is that the protein content of grass can be raised by increasing the amount of nitrogen applied. Furthermore, a reference to the protein yield curve for Treatment D in Graph II suggests that manuring and cutting intervals should be synchronized in order to give maximum yield of protein.

It has been shown that the protein content of grass was raised with the increase in the amount of sulphate of ammonia applied. Whereas Henderson (4) was satisfied that the results of manurial trials suggested that an amount of not more than 4 cwt. of sulphate of ammonia per acre per year would give maximum benefit (under conditions similar to those obtaining at Serdang), examination of the response curve of Trial I, in relation to the probable value of grass, suggests that, at the current price (1955) of sulphate of ammonia (\$225.00 per ton), the optimum rate would be about 8 cwt. of sulphate of ammonia per acre per year. Manuring at 8 cwt. of sulphate of ammonia per acre per year and cutting at intervals of six weeks would yield grass with a protein content of about 2.46 per cent (wet basis). This level may probably be raised further, as indicated by the result of Trial II (Trial No. F.E.S.S. 67), by applying the optimum amount of fertiliser at the harvesting interval of grass—a probability that is worth further investigation. Other than by this method, protein content can only be raised, possibly to a much higher level than hitherto realized, by reducing the cutting interval to one of less than six weeks and applying the optimum dressing of sulphate of ammonia to coincide with this interval. The reduction of cutting interval however would necessarily be at the expense of longevity, vigour and possibly the yield of grass.

Failure to get high protein content with the optimum manurial dressing from grass cut at the optimum cutting interval would mean that grass alone would still produce only a small amount of the protein required in stock feed and that, until a more nutritious fodder grass is obtained or the costs of animal and other proteins are reduced, fodder legumes growing in abundance in this country should be fully utilized as a cheap source of protein. An agronomic investigation with the various fodder legumes would therefore be a logical starting point towards partial solution of the problem of a nutritious fodder supply for the development of the country's livestock industry.

Summary.

A description of two Guinea grass trials (Trials Nos. F.E.S.S. 78 and 67) is given, and cutting, sampling for chemical analysis and the types of analysis are described. The effect of manuring with increasing amounts of sulphate of ammonia (Trial No. F.E.S.S. 78) and the effect of frequency of manuring on protein content of Guinea grass (Trial No. F.E.S.S. 67) were examined and conclusions drawn.

Acknowledgements.

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Acknowledgment is also due to Mr. R. Henderson on whose study this work is in part based.

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THE EFFECT OF CROP ROTATION ON GROWTH AND YIELD OF PADI.

BY

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Introduction.

Wet padi cultivation in Malaya is virtually confined to alluvial clay soils, and many of these dry out very hard in the off-season while others, particularly those of the coastal regions of Perak and Selangor, remain swampy and support a vigorous off-season growth of sedges and other aquatic plants. Neither of these conditions favours off-season cropping; irrigation of the former type is rarely possible and hand watering is arduous and applicable only to small patches of vegetables or other high-value crops.

There are, however, certain favoured localities where regular rotation of padi with other crops is possible, and a short account will be given of practice and investigations in these areas.

The Tanjong Karang Irrigation Area, Selangor.

Certain portions of this large Irrigation Area on the Selangor coast are relatively well drained in the off-season, while the surface soil of muck or shallow peat is both easy to cultivate and retentive of moisture. In each year a variable acreage is cultivated in the off-season with dry-land crops, particularly maize, but appreciable areas are also planted with soya beans, tobacco and such fooderops as pumpkins and tomatoes. The extent of cultivation depends partly on the energy of the cultivators but also on economic factors such as the price of rubber and of maize. The approximate areas cultivated during the last three seasons were as follows:—

1953	—	1,550 acres
1954	—	2,965 "
1955	—	1,685 "

In 1953, the area cultivated was reduced by resettlement dictated by the Emergency, while the high price of rubber has this year caused some loss of interest since rubber tapping has proved to be more remunerative than farming.

The soils in the Tanjong Karang area are very fertile and it is not normal practice to manure either the padi or the off-season crops. Nevertheless, the latter give satisfactory yields and the wet padi is some of the heaviest-yielding in the country, yields of 800 to 1,200 gantang (gallons) per acre having been recorded. Farmers in the area maintain that off-season cropping does not reduce the yield of the subsequent

padi crop, and there is circumstantial evidence that the practice is wholly beneficial. Certainly, weed control in the padi is very much easier after a dry land crop than following fallow. Furthermore, the surface cultivation required by the dry-land crops appears to improve soil structure and it seems possible that the known beneficial effect of drying out wet padi soils in the off-season is enhanced by cultivation. In theory, this benefit would be a result of the accumulation of nitrate nitrogen in the topsoil in consequence of the mineralization of the soil organic matter. The C/N ratio would also be narrowed by oxidation of organic matter.

In April, 1953, a field experiment was designed to test the effect of wet and dry off-season cropping in this area, the planned treatments being as follows:—

- | | | |
|--|---|--------------------------|
| W—Soil kept flooded in the off-season. | { | Cropped with Taiwan padi |
| | | or
Sedge fallow |
| D—Soil kept drained in the off-season. | { | Cropped with maize |
| | | or
Dry fallow |

There have been considerable difficulties in carrying out this trial, partly due to the close proximity of the wet and dry treatments since the sub-soil has proved to be very permeable. Flooding and pest damage have also contributed to these difficulties, and no results of value have yet been obtained. Nevertheless, the experimental *batas* (bunds) have now had plenty of time to settle and this factor, taken in conjunction with recent improvement to drainage, makes it probable that valuable results can reasonably be expected in 1956 and subsequent years.

Experiments in Province Wellesley.

Experiments carried out at the Bukit Merah Padi Experiment Station before the war have shown that off-season cultivation leads to increased yields of padi in the first few years. Provided that manuring is practised, satisfactory crops can usually be harvested from groundnuts, sweet potatoes, ladies fingers, brinjals and cowpeas (2). The provisional conclusion was reached that, at least in the first few years, it was the cultivation for the off-season crops, and not the manuring, which produced the subsequent increased padi yield.

In order to study this effect over an extended period, a trial was laid down in 1947 with the following treatments:—

- A. Normal fallow in off-season.
- B. Fallow growth manured.
- C. Sweet potatoes cultivated without manure.
- D. " " " " with manure.
- E. Groundnuts cultivated with lime.

From 1947 to 1950, plots receiving Treatments B and D were split, half being manured with buffalo manure at 10 tons per acre and

the other receiving 3 cwt. per acre of an NPK mixture containing the following fertilisers:—

sulphate of ammonia	—	95	parts by weight
superphosphate (18% P_2O_5)	—	117	" " "
muriate of potash	—	16	" " "

This layout proved to be unsatisfactory and, from 1951 to 1954, the whole plots were manured with 5 tons per acre of buffalo manure plus 2 cwt. per acre of NPK. In all cases the plots planted with groundnuts were manured with 30 cwt. per acre of ground limestone.

Yields from the sweet potato crops were usually poor, with a large percentage of tubers damaged by weevils. In some years the crop was negligible owing to flood damage. Groundnuts proved to be much more suitable and crops were usually satisfactory and often quite good. In later years, crops improved as the staff acquired skill and experience.

The effects of off-season cropping on subsequent yields of padi are summarized in Table I.

Table I.
Effect of Treatments on the Padi Crop.
(lb. grain per acre)

Season	Manure minus No Manure	Significance	Sweet Potatoes minus Fallow	Significance	Mean Yield of Padi
		per cent		per cent	
1947-48	273	1	473	1	2,121
1948-49	110	0.1	580	0.1	2,734
1949-50	5	N.S.	23	0.1	174
1950-51	122	N.S.	16	N.S.	1,506
1951-52	94	N.S.	285	0.1	2,300
1952-53	130	N.S.	353	0.1	2,087
1953-54	174	1	441	0.1	2,013
1954-55	171	1	473	0.1	2,010

From the information contained in Table I, it can be concluded that good cultivation in the off-season benefitted the subsequent padi crop in seven seasons out of eight and that manuring the crop was only of benefit to the subsequent padi crop in four seasons out of eight.

This conclusion pre-supposes that the technique of off-season cultivation has been mastered: if cultivation is too deep the following padi crop may suffer.

Experiments in Perak and Pahang.

One type-of-cultivation trial carried out at Dong Padi Test Station, Pahang, in 1950-51 had the following sub-treatments:—

VO — Off-season crop, unmanured.

VM — „ „ „ manured with NPK.

C — Control, — no off-season crop.

Mean yields of the subsequent crop of padi were:—

VO — 3,020 lb. per acre	} ± 93.5
VM — 3,080 lb. per acre	
C — 2,460 lb. per acre	

It was noted that the manured plots were more weedy than the unmanured ones, but yields did not differ appreciably. However, the effect of off-season cropping was to increase the subsequent padi crop by 580 lb. of grain per acre, and this was highly significant ($P > 0.001$). In this trial the off-season crops failed and it was not repeated.

Similar experiments were carried out at the Talang and Briah Padi Experiment Stations in Perak between 1951 and 1954 but for one reason or another the off-season crops failed, often because of unsuitable weather conditions for cultivation and planting. In only one instance did such off-season cultivation have a beneficial effect on the subsequent yield of padi—namely when crops of groundnuts and soya-beans were grown and harvested green, this being dictated by their lateness. It is clear, therefore, that in such areas there can be no economic justification for off-season cropping although green manuring might be worthwhile provided that the crop could be established cheaply.

Experiments in Malacca.

The high cost of hand construction of raised beds for off-season cropping suggested that this practice would not become popular unless it could be mechanised. Accordingly, a depth of cultivation and off-season cropping trial was laid down in 1948 at the Padi Experiment Station, Pulau Gadong, and continued for five years. The main treatments in this trial were deep (8 in.) and shallow (4 in.) cultivation for the padi crop, but there were four sub-treatments:—

Off-season fallow.

Green manure cultivated.

Groundnuts.

Sweet potatoes.

In no season were there differences in yield of padi caused by these sub-treatments and, during the experimental period, average yields fell steadily, as indicated below:—

Season	Mean Yield of Padi (lb. per acre)
1948-49	2,063
1949-50	1,825
1950-51	1,655
1951-52	1,292
1952-53	1,327

This fall in yield was attributed to the necessity for carrying out mechanical operations on land which was not always in a suitable condition.

Certainly there was a deterioration in soil structure, and it was concluded that mechanisation was impracticable under such conditions.

It is interesting to note that off-season cropping has been practised on Malacca padi fields for upwards of 37 years but the Chinese cultivators take great care in the hand preparation of the raised beds (1).

The Use of Green Manures for Padi.

The cultivation of green manures on padi land is a well established practice in certain countries but it has never found favour in Malaya. In the north, the clay soils dry out after padi harvest and deep cracks develop as the water-table falls. Elsewhere, padi land is often alternately dry or subject to floods of short duration, and this favours the rapid growth of a natural sedge flora. Where the surface soil is an organic clay or muck, the succulent-stemmed sedge *Scirpus grossus* (menderong) is frequently dominant and this is well recognised in Perak as an indicator plant of first-class padi land.

On the one hand, there are conditions militating against the cultivation of leguminous green manures, and on the other hand, conditions favour the natural growth of a non-leguminous, but very bulky sedge crop which adds considerable quantities of organic matter to the land. It is perhaps not surprising, therefore, that the active cultivation of green manures has not found favour with Malayan padi growers: rather do they prefer to graze the dry lands of the north, to grow cash crops on the occasional favoured field in Selangor or to let the natural sedge growth develop unaided.

In the past, many experiments have been designed and laid down in order to demonstrate the hypothetical value of green manures, but almost without exception these have failed because the green manure crops either failed completely or else grew poorly and were swamped with a weed growth of grasses and sedges.

In 1952, it was realized that no progress could be made unless green manure crops could be found which would grow fairly reliably. It was then decided to lay down observation plots with the most promising of these, and the following short list was selected in the light of previous experience:—

<i>Crotalaria juncea</i>	— Sunn Hemp
<i>C. striata</i>	
<i>Tephrosia noctiflora</i>	
<i>Sesbania aculeata</i>	— Daincha
<i>S. speciosa</i>	
<i>S. aegyptiaca</i>	
<i>S. roxburghii</i>	

By the end of 1954, it had been established that only *Sesbania aculeata* and *S. speciosa* deserved further attention since both species had proved to be resistant to flooding once they had reached a moderate size and the former was also resistant to drought. Accordingly, a trial was laid down on five stations to study the effect of broadcasting

germinated seed of *S. aculeata* into the growing crop of padi one week before harvest. At the same time, the effect of manuring the padi with NPK was incorporated factorially into the layout. This experiment will be continued for three seasons, but it is of interest to note that, in 1955, the green manure grew well at only one station, grew unevenly at another locality and failed to grow at the other three sites because of lack of rain.

Discussion.

Where wet padi can be grown in rotation with some other crop in the off-season this practice is clearly of benefit as it is sound farming policy and appears to help in weed control. Such off-season cultivation may also benefit the subsequent padi crop, this effect being one of improved cultivation rather than a manurial one. In most areas, however, comparable increased yields of padi can be obtained by direct manuring, and off-season cultivation can only be justified by the immediate returns from the crop and not from the delayed returns from the subsequent crop of padi.

We have seen that, in Malaya, rotation of padi with a dry-land crop is at present only possible in certain limited, favoured areas. That it could be extended somewhat in these localities is clear but such extension is restricted by economic factors. Maize is a typical example of a crop with a limited local market: it is usually sold as green cobs and the farmer may receive only 1 to 2 cts. per cob at a time when the retail price in the larger towns is 8 cts. There is admittedly a small market for dried grain but this does not yield the profit to which Malayan smallholders are accustomed. In this connection it is worth noting that a smallholder can easily earn M.\$4 (9s. 4d.) per day (October, 1955) from tapping rubber on a share crop basis, and such a man would naturally not take kindly to any form of subsistence farming.

Other off-season crops may be more profitable; indeed the return from tobacco may greatly exceed that from padi, as witnessed by the following figures:—

Crop	Yield per Acre	Gross Return per Acre
Padi	400 gantangs (50 bushels)	M.\$200
Tobacco	800 lb. dried leaf	M.\$480

It is perhaps not surprising that certain industrious Chinese cultivators would prefer that irrigation water be withheld so that dry land crops could be grown throughout the year.

In recent years locally selected soya beans have been giving promising crops on padi land, and these may well extend the area of off-season cultivation in favourable localities. Jute is another crop which may lead to expansion, since promising experimental crops of *Corchorus capsularis* var. *Segama* have been cultivated in Selangor.

Summary.

1. Off-season cultivation of dry-land crops is limited in area in Malaya by climatic, soil and economic factors.

2. Cultivation in the off-season usually leads to increased yields from the subsequent padi crop and manuring sometimes enhances these yields.
3. Injudicious cultivation of padi land carried out when soil conditions are unsuitable may reduce padi yields as a result of damage to soil structure. Similar harmful effects may also result from excessively deep cultivation.
4. The successful rotation of padi with other crops facilitates weed control.
5. There is no indication that the practice of green manuring is likely to become established in Malaya except in so far as the natural weed growth in the off-season is sufficiently dense to be considered a green manure.

Acknowledgement.

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NOTES ON CURRENT INVESTIGATIONS (RESEARCH) JANUARY TO MARCH, 1956.

Compiled by the Assistant Director of Agriculture (Research)

Padi.

VARIETY SELECTION

Most field experiments have been harvested and experimental records are being completed. There have been few failures this season but yields have been lower than usual in those areas which experienced drought during the growing season.

The results of three variety trials completed in Kedah have been analysed. In a three-year trial of medium term varieties, Subang Intan 117 significantly outyielded all other varieties, and Raja Muda 4 significantly outyielded Mayang Ebos 80, Anak Didek 39 and Serendah Sungai Dua 25 (Trial K P. 73). In Trial K P. 74 at Sala Kanan, Kedah, Subang Intan 16 significantly outyielded all other varieties, and both Anak Kuching and Subang Intan 117 were significantly better than Subang Intan 11, Mayang Pasir and M.E. 80.

Local Hybrids

Yields of some of these progenies are extremely promising, especially at Telok Chengai Padi Experiment Station, Kedah. Segregation is much less apparent and in some cases families appear to be homozygous.

Cuttack Hybrids

Selection has proceeded satisfactorily at Telok Chengai and Pulau Gadong, Malacca. Seed samples of 13 further crosses have been received from Cuttack, India, and will be grown in selection plots in the coming season.

INSECT PESTS

Experiments on the control of stem-borers with insecticides have been continued in Krian. Harvesting and recording of results from the experiments on time and rate of application of insecticides have been completed and results are now being worked out. In one experiment, spraying with DDT at intervals of two weeks resulted in an increase in yield of nearly 80 per cent, indicating the very great losses which may be caused by stem-borers.

Specimens of larvae of the dark-headed rice borer *Chilo traxa polychrysa* (Meyr.) were received from North Borneo. This insect found in Malaya, Java and Bali, had not previously been recorded from North Borneo.

SEED TREATMENT

The test of the effect of fungicidal seed dressing on the viability of seed in storage has been continued. Viability of the seed, after eight months, has not been affected by initial treatment.

In another experiment, to discover the effect of the age of seed on the results of seed dressing, the effect of seed dressing continued to become more marked with increasing age of the seed. The seed has now, in the eighth month of the experiment, almost lost its viability, but in the last test the greatest percentage increase in germination of dressed seed over undressed seed had risen to 64.

DISEASES

Investigations into the fungus flora of padi seeds continued during the quarter.

Diseases investigated included Blast (*Piricularia oryzae*), leaf spots (*Helminthosporium oryzae* and *Cercospora oryzae*), Sheath Blight (*Rhizoctonia solani*) and Penyakit Merah.

MINERAL NUTRITION

In an experiment on sodium toxicity, salt tolerant and normal padi varieties were under test. Leaf analyses revealed that both types took up large quantities of sodium. This disproves the theory that the resistance of the salt tolerant variety might be due to its ability to absorb only small quantities of sodium.

The padi on peat experiment conducted in the padi cage at Kuala Lumpur was harvested at the end of January, 1956. The yield of grain in the nitrogen-fertilised tanks was nearly twice that of the tanks which received no nitrogen. The average yield of grain by six plants in tanks without nitrogen was 213 gm. (eight tanks) and that with nitrogen was 403 gm. (seven tanks). The yield of nearly 1 lb. of air-dried grain by six plants (three of the nine plants in the tank were harvested at the flowering stage) in the completely fertilised tank is as good as some of the best yields obtained with fertilisers on normal padi soils. These results have not been confirmed in the field.

KEDAH SOIL SURVEY

Work in the north Kedah Plain recommenced on the 1st February, mostly north of Alor Star and in a small area east of the 10th to 18th milestones on the Alor Star—Sungei Patani road which was not finished last year. In the large 'gelam' area near the Perlis border, the high watertable made it impossible to dig pits and the soil was examined to a depth of 36 in. by means of auger borings. Digging of pits and soil sampling has been completed in the north Kedah Plain.

Cacao.

SELECTION

During the quarter, 9,845 pods were harvested from experimental fields at the Federal Experiment Station, Serdang, and over 1,000 have

been analysed for bean content. Losses due to jungle pests have been heavy but there are indications that the peak crop is being harvested a little earlier this year.

Seed has been distributed as follows:—

1,400 seeds of 18 different progenies to the Federal Experiment Station, Jerangau;

6,000 seeds from Upper Amazon trees to Jerangau Estate, Trengganu; and

2 pods from each of 13 selected Upper Amazon trees to North Borneo.

Arrangements have been made to introduce clonal material of S.C.A. 6 and S.C.A. 12 from Trinidad to establish a foundation of cacao resistant to 'Witches Broom' in Malaya.

INSECT PESTS

In an experiment at Serdang to compare the effectiveness of different insecticides used as foliage sprays against *Apogonia*, estimates on relative leaf injury indicated that the best results were obtained with lead arsenate at a concentration of 0.4% or with a 25% DDT miscible liquid at a concentration of 0.08%. This concentration of DDT was double that used previously in this experiment and has given considerably better results than the weaker mixture.

DISEASES

Cacao Disease Survey

The survey of cacao areas at Serdang has been continued. One of the most interesting results of the survey to-date has been the discovery of the fungus *Calonectria rigidiuscula* associated with many of the cases of die-back which are prevalent in some fields. This fungus causes (in association with capsid attack) severe die-back of cacao in West Africa, but its pathogenicity under local conditions has not yet been tested.

Pink Disease (*Corticium salmonicolor*) occurred in one locality in Pahang.

Cacao Seedling Leaf Diseases

Observations on cacao seedlings growing in sand culture are continuing. After 10 months' growth, lack of calcium has resulted in very severe stunting and complete or almost complete defoliation. Lack of magnesium has caused slightly less severe stunting and defoliation is not so marked. Lack of potash, although causing severe scorching of the leaf edges, has so far caused comparatively little adverse effect on growth. In a second experiment, the effects of lack of nitrogen and phosphorus are also being studied.

SOIL SURVEYS

Trengganu

Field work for the present season commenced on the 5th March and the Soil Surveyor has a team of three assistants with him. In addi-

tion, he has two Agricultural Assistants, one from Perak and one from Negri Sembilan, who are being given a two months' course in soil surveying.

A detailed reconnaissance trip was made in the western sector of the Bukit Bauh Forest Reserve between the Sungei* Dungun and the Sungei Paka and the mapping of the boundaries of an area of good soil (consisting mainly of Rengam and Jerangau Series) suitable for cacao was completed.

Towards the end of March, a detailed reconnaissance survey was commenced in the Sungei Tebak—Bukit Bundi region of south Trengganu. The mapping of the large area of soils suitable for cacao in this area should be completed by mid-April.

Pahang

An Agricultural Assistant from the State, under the direction of the Soil Surveyor, carried out further soil survey work in the Maran Road area.

Oil Palm.

BREEDING & SELECTION

New Planting. Trial 0.26 at Klanang Bahru Estate, Morib, Selangor.

This 12-acre trial was planted on the 5th and 7th January. It is designed to test the potential value of five semi-Deli, semi-dumpy *tenera* progenies compared with that of the control of dumpy-Deli *dura* palms.

Trial Tr. 29 at the Federal Experiment Station, Jerangau.

This trial was brought into bearing at 34 months. During the first three months of harvesting, results indicate that Ulu Remis progenies are more precocious than the others in the trial.

INSECT PESTS

Treatment of all palms against the bagworm *Cremastopsyche pendula* Joannis has been carried out on an estate in south Perak. BHC 0.65 % gamma isomer was applied by power duster and dieldrin and DDT concentrates by T.I.F.A. (Todd Insecticidal Fog Applicator). Best results were obtained with dieldrin. BHC gave slightly less effective control while DDT gave poor results. Although both in heavily attacked and unattacked fields the total annual yields of fruit bunches per annum and per acre have risen for the last few years, there are obvious signs of extensive leaf injury.

DISEASES

A severe leaf spotting and die back of young oil palm seedlings, sometimes resulting in death, has been reported from several widespread

* Sungei = River.

localities. As has previously been reported, two fungi, species of *Curvularia* and *Gloeosporium*, are invariably found on diseased areas. Inoculation experiments indicate that the *Curvularia* is a primary parasite and can attack undamaged leaves, whereas the *Gloeosporium* does not appear to be parasitic, all attempts to inoculate it into uninjured or injured leaves having failed.

LEAF ANALYSES

Analyses of the leaf samples collected from various estates for the nutrient survey have continued, and the relative merits of expressing results on dry matter basis and ash basis are being investigated. One outstanding fact so far noted is that the ash content for the fronds from palms grown on coastal clays is often more than twice as high as that from palms grown on inland soils. However, when results are expressed on dry matter basis, this difference is evened out. The reason for this large difference is at present unknown.

Coconut.

SELECTION

Routine harvesting of open pollinated nuts from the old Port Swettenham station has continued and seedlings have been transplanted to the nursery at the Federal Experiment Station, Telok Bharu, Perak.

INSECT PESTS

Damage by the slug caterpillar *Chalcoscelis albiguttata* (Snell.) was reported in mid-February as involving 200 acres of 30-year old palms in a coastal area of Selangor. Dieldrin at 1.5% actual (Dieldrex 15 at 1:10) was applied by means of a "Micron" sprayer. The attack is reported to be affecting new areas but the treatment has on the whole been effective.

DISEASES

Severe leaf spotting occurred on the leaves of young coconuts in one locality in Perak. A species of *Helminthosporium* not previously recorded on coconut was common on the lesions. *Pestalotia palmarum* was also present on the dead areas on the older leaves.

Pineapple.

CHEMICAL ANALYSES

Chemical examination of fruits from the Federal Experiment Station, Jalan Kebun, Selangor, harvested at the end of November and the beginning of December, 1955, has been completed. The two main sources of samples were the SEL. 95 (type of potash) and SEL. 98 (level of potash) experiments. The results indicate the following:—

(a) SEL. 98

- (1) steady increase of total sugar and potassium in Singapore Canning fruit with increasing application of

potash up to the maximum applied—200 lb. K_2O applied as muriate of potash per acre;

- (2) a sudden jump in total acidity and fall in pH when 50 lb. K_2O as muriate of potash per acre is applied and thereafter remaining constant in spite of increasing application; and

(b) SEL. 95

- (1) there was no significant difference in fruit quality between plants receiving potash as muriate or as sulphate;
- (2) no difference could be found when potash was applied in a ring round the plant or when mixed with five times its bulk of peat and placed in the outer leaf axils.

PROCESSING

Vacuum Syruping

A series of experiments was carried out to find the advantages, if any, of mechanical exhausting as against thermal exhaust as now practised in the canneries. Glass packs of Singapore Canning—golden, standard and sub-standard grades—were put down. Nine lots of each were packed. The fruit was held under 23 in. vacuum for 30 seconds, 1 minute, $1\frac{1}{2}$ min., 3 min., 5 min., 7 min., 9 min., 11 min. and 13 min. and the syrup was added while fruit was still under vacuum. As against controls (thermal exhaust), it was shown that holding of fruit under mechanical vacuum of 23 in. for 1 min. does give an improvement in colour and an increase in drained weight. This is due to the removal of white flecks and the replacement of air pockets with syrup.

Pineapple Juice. Staining of Tin-Plate

The Research Department, Metal Box Co., Ltd., has reported that this staining was due to the presence of sulphur compounds. Samples of sugars (as used in the canneries) and straight juice were tested. Results showed that the sugars were sulphur-free but juice gave positive tests for sulphur compounds. Further tests are in progress.

INSECT PESTS

In the observation plots at the Federal Experiment Station, Jalan Kebun, population counts of mealy bugs (*Dysmicoccus brevipes* (Ckll.)), after respraying with dieldrin 0.17% (Dieldrex 15 at 1:80), showed that the four sprayed strips had only one-third of the number of pineapple plants heavily infected compared with the four untreated plots, which had only 44 per cent plants free of mealy bugs. Ants were noticeably scarcer in the treated strips, the most numerous species being *Tapinoma indicum* Forel, followed by *Iridomyrmex excisus* (Mayr.) and *Pheidole megacephala* (F.). Plants in the sprayed plots appeared much greener and healthier than those in the unsprayed plots.

A series of pot trials has been set up with mealy bugs collected

from unwilted and wilted plants. The object of these trials is to ascertain if mealy bug wilt is caused by a virus or by toxic secretions in the saliva.

DISEASES

Information on the relative varietal susceptibility of young plants to bacterial heart rot is not available from the field as only the variety Singapore Spanish is extensively planted in areas where the disease occurs. A laboratory artificial inoculation test has therefore been carried out. This indicated that the four varieties Singapore Spanish, Sarawak, Selangor Green and Mauritius are all susceptible.

Another laboratory test (using Singapore Spanish plants) confirmed the view that the bacterium causing heart rot cannot attack uninjured plants but that injury in the heart region is necessary for infection to take place.

An unusual type of bacterial disease occurred on specimens received from an estate in Johore. Leaves were attacked as in typical heart rot but the plants were bearing fruit and the rot had extended into the base of the fruit stalk. Isolations proved that the disease was caused by the same species of *Erwinia* that causes normal heart rot and the specimens are therefore regarded as an atypical example of this disease.

Other Crops.

SWEET POTATOES

Varieties

The trial at Serdang to select varieties giving a good yield of tops with frequent (2-monthly) cuttings has been concluded. No fertilisers were used.

Results from eight varieties are as follows:

Variety	Yield (lb. per acre)	
	Tops	Tubers
Samar Big Holttum	56,628	4,574
Samar Big Yellow	72,745	10,019
Kang Kong 58	43,451	26,571
Seranggon 3	44,540	3,485
Eng Chai Cheng	52,490	10,672
Eu Tin	43,778	8,712
21 Taiwan Fan See	45,085	18,077
Hoey Tong	36,590	15,246

Pests

Severe attack by the weevil *Cylas formicarius* L. to tubers of sweet potatoes was seen in a crop grown in peat soil in Selangor. Aldrin at 0.1% active (Aldrex 2 at 1:200) was recommended.

GUAVA (JAMBU BATU)

This fruit has a reputation for high pectin and ascorbic acid content. A small lot was collected locally and processed into a good, clear, full flavoured jelly. Further processing experiments will be carried out, as this fruit has promising commercial possibilities.

Miscellaneous Pests and Diseases.

TEA

The results of three spraying experiments carried out against Blister Blight at Cameron Highlands have shown that none of the two copper and two organic fungicides tested was more effective than the standard copper oxide formulation.

MAIZE

A disease, in which the lower leaf sheaths were affected by a rot later extending on to the leaf blade, was found to be due to the common fungus *Rhizoctonia* (*Corticium*) *solani*. This is the first record of the fungus on maize. Another host of this fungus recorded for the first time was *Asystasia coromandeliana*, on which a leaf and stem rot was caused.

The maize rust *Puccinia polysora*, which has recently caused widespread damage in Africa, is now known to occur in Malaya; specimens having recently been identified by the Commonwealth Mycological Institute. The earliest specimen was collected in Selangor in 1950, and it seems likely that the rust arrived in Malaya not long before that date as the only previous record of a maize rust is of the very similar but much less serious *P. sorghi*.

As the fungus has been in Malaya for at least five years and no reports of damage caused by it have hitherto been received from field officers or from the public it would appear that it is causing comparatively little damage. In an attempt to find out how much loss of crop is being caused by the rust, experiments are being laid down in two localities in Selangor.

WATER MELON

Specimens of water melon plants received from Kelantan were found to be affected by a wilt. The causal organism is a species of *Fusarium* not previously recorded on this host.

RAMBUTAN

Rather heavy damage to fruits of the rambutan was caused by *Acrocercops cramerella* Snell. in Selangor. This pest, known in Java as the Cacao Moth, has not yet been recorded from cacao in Malaya.

CATERPILLAR OUTBREAK

Extensive injury to 15 ft. high bushes of *Indigofera teysmanni* was caused in February at an Experiment Station by larvae of the Noctuid moth *Tiracola plagista* Walk. Fogging was done with DDT concentrate

and oil by means of a Dynafog and three Swingfogs as well as spraying with lead arsenate and DDT wettable powder from a 'Micron' sprayer and 10 knapsack sprayers. This checked the pest, which was also feeding on a variety of herbs over the 25 acres involved, 10 being seriously affected.

TERMITES

Soil impregnation tests with various strengths of Dieldrex 15 show an unexpected increase in toxicity to *Macrotermes gilvus* Hag. at all strengths from 1:500 to 1:3,000. These tests were started two years ago and the soil has not been exposed to rain.

Examinations of buried plastic cables indicate that those with a polythene sheath impregnated with lead naphthenate are more resistant to insects than without this chemical. One instance of rather extensive damage was caused by the carpenter ant (*Camponotus nicobarensis* Mayr.) but termite (white ants) damage appears so far to be very slight.

Plant Imports and Exports.

As usual, numerous consignments of planting material being imported or exported were examined. In one consignment of beans from the U.S.A., live specimens of a beetle (*Bruchus* sp.) were intercepted.

Laboratory Investigations.

CATION EXCHANGE CAPACITY OF SOILS

About 100 samples have been examined by the barium chloride leaching method. As with any other similar method, soluble salts interfere and must be removed by washing the soil sample with water. Several of the coastal soils in Kedah have large amounts of soluble salts of calcium, sodium and magnesium.

The C.E.C. (Cation Exchange Capacity) of the Kedah soils generally falls within the range of 20 to 40 m.e. per 100 gm. of soil. The percentage saturation of the exchange complex is highest (often over 90) in the newly formed coastal soils, and proceeding inland, it falls to as low as 10. The Trengganu soils have values of 20 to 30 for the C.E.C. and the percentage saturation is seldom above 20. Soils from the Kelantan Deficiency Area have values between 10 and 20 for C.E.C. and the percentage saturation is very low (between 4 and 8).

Exchangeable aluminium was determined on several extracts from the Kedah soils and was found to be almost negligible.

TANK EXPERIMENTS

The leachings from the limed and non-limed tanks continue to be collected. Even under good leaching conditions sulphates move out of the soil quite slowly. Leachings which contained approximately 6.0 per cent SO_4 on the 1st October, 1955, contained 0.015 to 0.2 per cent at the end of March, 1956.

NOTES ON CURRENT INVESTIGATIONS (AGRONOMY)

JANUARY TO MARCH, 1956

Compiled by the Senior Agronomist

Padi.

Three-plot manurial trials on cultivators' land have given interesting results from several States. The treatments tested were as follows:—

S = 30 : 30 : 15 lb. per acre—N : P₂O₅ : K₂O using double superphosphate.

P = 30 : 50 : 15 lb. per acre—N : P₂O₅ : K₂O using Christmas Island rock phosphate.

O = control, no fertiliser.

In Negri Sembilan, good responses have been reported from all districts except Tampin. S was markedly superior to P in Seremban and Jelebu but only slightly superior in Kuala Pilah and Port Dickson. Responses to fertiliser range up to 180 gantangs (gallons) per acre.

The same trials on the Selangor coast have given promising results in spite of the high soil fertility. Some of the yields so far available are as follows:—

Locality	Sekinchang	Sawah Sempadan
Number of trials	18	7
Treatment S	977 g/a	564 g/a
Treatment P	975 "	532 "
Control O	933 "	448 "

It is of considerable interest to note that control yields at Sekinchang varied from 740 to 1,240 gantangs (4,144 to 6,944 lb.) per acre.

Good responses to fertiliser have also been recorded in this series of trials in Johore where soils are deficient in phosphate.

Particularly good yields have been recorded from manured fields and experimental plots in Pulau and Rantau Panjang, Kedah, and from Gelugor in Trengganu. As against this, experimental yields have been low in Perlis and Langkawi Island.

In a green manure experiment, the first sowings of *Sesbania aculeata* grew poorly in Kedah because of flooding while second seedlings failed due to drought. However, at Pasir Mas, Kelantan, growth has been quite good this year. The variation in these results is typical of experience to-date in attempts to grow green manures on padi land in Malaya.

At Pulau Gadong, Malacca, harvesting padi with a lightweight Austrian scythe has proved to be 2½ times as fast as when a sickle is used. Padi cut with a scythe was somewhat more difficult to thresh and yields were reduced by about 25 per cent because of shattering.

Cacao.

There has been considerable activity at the Federal Experiment Station, Jerangau, Trengganu, where there are some 15,700 seedlings in nurseries. Pest damage has been particularly severe, with squirrels and musang damaging many pods; but shooting has been effective in controlling them. *Helopeltis* was in evidence in January and fields were fogged with D.D.T. but damage is now reported to be once again on the increase.

In the 17-acre establishment experiment from felled forest there has been considerable erosion recorded in sloping areas but this is now being controlled by grasses and nurse-crops. Many casualties amongst the latter have been supplied, notably 304 bananas and 197 tapioca cuttings. Most of the damage to the tapioca was caused by wild pigs.

Cacao is underplanted in dry padi in two acres of this experiment. The dry padi was a virtual failure but the cacao seedlings, planted 6 x 6 ft., are now growing vigorously although they had a slow start.

In view of the interesting results obtained from the lime-phosphate experiment this is being duplicated on another site containing 2½-year old trees.

At Kampong Awah, Pahang, a long-term manurial experiment was planted out by the 11th March and no casualties have been recorded. This trial will receive uniform manuring for the first three years.

At the Federal Experiment Station, Serdang, *Helopeltis* has been controlled by fogging with D.D.T. in Sovacide PY. This carrier is cheaper than the oil used previously and it has been found not to have any phytotoxic effect.

Different possible methods of pruning have received considerable attention recently and observations on the various methods have started both at Serdang and Jerangau so that a well-planned experiment can be laid down in 1957. At Serdang, these observations are being made on both Amelonado and Upper Amazon, these being budded on to surplus nursery stocks in order to obtain uniform growth in a convenient locality.

Propagation work at Serdang has increased recently and 470 fan cuttings from trees selected by the Botanist have been put into rooting bins as well as 50 cuttings of each of 15 Upper Amazon selections. A rootstock trial is to be planted at Serdang next September-October and the necessary seedlings have been sown.

A storage and viability trial on Amelonado cacao at Serdang has shown that seed from waxed, ripe pods and untreated, unripe pods may be expected to retain 100 per cent viability for two weeks. However, waxing of unripe pods reduces viability.

Coconuts.

At the Federal Experiment Station, Telok Bharu, the field drains completed in December are slowly taking effect and the soil is weathering nicely.

Pineapples.

At the Federal Experiment Station, Jalan Kebun, it is very noticeable that the variety Singapore Spanish is more susceptible to potash deficiency than is Sarawak in so far as visual leaf symptoms are concerned.

A meeting was held in March, in Kuala Lumpur, with growers and packers in order to discuss fully the results of agronomic research. This was of great value to all concerned.

Co-operative trials in south Johore have been interrupted by plantation strikes. Field work in this area is also handicapped by communist terrorist activity.

Tea.

In the nitrogen manurial experiment at the Federal Experiment Station, Cameron Highlands, mean yields for the first half of the fourth year of the first pruning cycle were as follows:—

lb. nitrogen per acre (annual)	0	40	80	120
lb. made tea per acre	184	254	330	379

This trial was pruned at the end of 1955, was tipped in January and came into plucking again in March.

Pastures.

The factorial NPK manurial trial on *Axonopus compressus* under shade of *Enterolobium saman* failed to show a response to potash manuring in 1955 although the effect of nitrogen was linear and most marked. Dressings of basic slag apparently reduced the beneficial effect of nitrogen. The n_2p_0 yield of 24.66 tons of fresh cut grass per acre per year was comparable with that of Guinea grass on Serdang soils. The n_2 treatment amounted to 8 cwt. sulphate of ammonia per acre per year.

Some of the new grasses under study in Kuala Lumpur are showing very considerable promise.

Fodders.

A new Guinea grass manurial experiment was planted at Serdang during the quarter under favourable weather conditions.

Derris.

An area of one square chain of *Derris elliptica* was lifted from deep peat at the Federal Experiment Station, Jalan Kebun, Selangor, in January at the age of two years. This was a variety and manurial observation trial receiving the treatments given in the table on the next page.

The figures for treatment yields must be interpreted with reservation because they are derived from only single plots per treatment. In

spite of this, and of the low rotenone and ether extract contents, it is held that the results give some indication that manuring may increase both yields and quality.

Manurial Treatment	Varieties					
	Sarawak Creeping			Changi No. 3		
	Weight of Marketable Root (lb. per acre)	Rotenone (per cent)	Ether Extract (per cent)	Weight of Marketable Root (lb. per acre)	Rotenone (per cent)	Ether Extract (per cent)
Control	551	2.27	14.25	236	3.97	17.49
Burned	954	2.48	13.80	962	4.95	20.19
Limed	3,012	3.48	15.40	949	3.62	16.30
Burned & limed	1,706	4.01	15.38	1,750	5.11	20.03

A manurial and cultural trial planted last year on the same Station is now well established: in general, growth of *D. malaccensis* v. Sarawak Erect has been superior to that of Sarawak Creeping.

Foodcrops.

The dent maize variety Salisbury White is being grown both at Serdang and Kuala Lumpur—at the former locality in a variety trial and at the latter in an isolation plot. At both places it has been heavily attacked by the rust *Puccinia polysora* but this occurred at a late stage of growth and will not perhaps influence yield.

The New Zealand sweet potato "Kumera" is being grown for observation at Kuala Lumpur. Quality at four months old was good. Optimum maturation period is being determined by harvesting at monthly intervals.

Tobacco.

A few plants of Dixie Bright and Hickory Pryor are being grown at the Federal Experiment Station, Kuala Lumpur, for observation and seed. A satisfactory seed crop of White Burley has recently been harvested.

Assistance has been given to a large Perak grower to obtain experimental quantities of seed of the Canadian variety Gold Dollar. This Virginian tobacco is normally flue-cured and trials of this are envisaged.

Livestock.**GOATS**

The feeding trial at Bukit Mertajam has now been completed and results are being studied. The relative efficiency of the kampong ration of fodder grass and forest leaves has been surprising but not all animals reached a slaughter weight of 80 lb. liveweight. Feeding with concentrates and grass naturally gave quicker growth but the resulting meat was somewhat too fat.

CATTLE

Three bull calves have been born to the Bali herd at Serdang.

MECHANISATION

Half-yearly Report, October, 1955, to March, 1956

Compiled by the Agricultural Engineer.

Dry Padi Harvesting Trials.

Dry padi harvesting trials were again carried out at Paya Besar, Pahang. Over 60 acres, partly in the State Agricultural Station and partly in an adjacent colonization area, was successfully harvested. The padi was cut with a Bisset binder semi-mounted on a Ferguson tractor and threshed by a Ferguson-powered Rajah thresher.

This year's trials were of particular interest as the field conditions under which the binder worked approached very closely those of mechanised areas in temperate climates and consequently similar out-puts were realized. Unfortunately, the individual field surfaces were rather rough and this undoubtedly slightly reduced the rate of work. The field surfaces could, of course, be levelled by using a simple "A"-frame type leveller before drilling the seeds. It is apparent that the problem of transporting the padi sheaves from the field to the thresher can be usefully approached by fitting special racks to conventional tractor trailers as is done in temperate mechanised cereal growing areas.

Trans-Perak Pilot Mechanisation Farm.

PROGRESS TO-DATE

Nearly one hundred acres has been cleared, windrowed and burnt. The area has also been disced. At present a detailed contour map of the area is being prepared as a preliminary step to designing the field and irrigation system.

BUILDINGS

The working drawing and the necessary templates for a 24 ft., uninterrupted span, 3 in 12 pitch, nailed trussed rafter with 4 ft. overhang as well as a supplementary drawing of the trussed rafter plate-column connector have been drawn up at the Workshop and Pool, Serdang. The design is based on 5 x 5 in. reinforced concrete columns and provides for 16 ft. sections. This design should be very suitable for a considerable range of service buildings common to agricultural stations such as tractor sheds, stores and livestock sheds. A tractor shed of four sections has already been constructed in the Trans-Perak Padi Pilot Mechanisation Scheme area and valuable building experience with this design has been gained. Working drawings of a four-section, combined storage-incubator-feed building for the State Agricultural

Station, Cheras, Selangor, have been made and construction is now in progress.

Recent Developments.

M.G.5 AND M.G.6 TRAILERS

A large capacity trailer mounted on two wheels with 600 x 16 tyres has been developed for use with the Ransome M.G.5 and M.G.6 tractors. The trailer body is 96 in. long, 36 in. wide and 12 in. deep. The overall length of the trailer is 117 in. and the overall width 51 in. It weighs 451½ lb. empty. On medium slopes and a difficult surface a load of 2,439 lb. was handled satisfactorily by an M.G.5 tractor.

LAND PLANE

Complete working drawings of an automatic-levelling type land plane, 29 ft. long and with a 7½ ft. blade, have been prepared and fabrication has been initiated at Workshop and Pool. This machine will be used for the final levelling of irrigated padi land just prior to drilling and subsequent flooding.

NOTES ON EXTENSION WORK

JANUARY TO MARCH, 1956

Compiled by the Acting Assistant Director of Agriculture (Field).

Weather.

In Kedah, Perlis and Kelantan, January and February were very dry months, but heavy rain was experienced in March. In Trengganu and Pahang, the north-east monsoon came to an end as usual in early February. Other States and Settlements reported fairly normal weather in January and February. An unusually wet March was experienced in almost the whole of the Federation, and this interfered with padi harvest in the later planted areas in Province Wellesley, Perak, Selangor and Malacca.

Padi.

The area planted with wet padi during the 1955-56 season did not come up to expectations, and, at 818,753 acres, fell short of the 1954-55 season by 13,827 acres for reasons that were partly connected with the weather and in part associated with a greater interest in rubber production. By the end of the quarter, 79 per cent had been harvested, with yields averaging 327 gantangs (gallons) per acre. This reward is rather more than had been expected.

Perlis was badly hit by drought during the season, and there was total crop failure on 1,413 acres and a partial failure on a further 2,982 acres. However, scattered rains during January and February helped to swell the grain on the late planted padi in Kedah, and average yields are expected to be little different to those of the 1954-55 season, when a moderate crop was harvested.

Kelantan has harvested good crops of dry padi and, with a wet padi crop ranging from fair to very good, expects to get little less than the near-record crop of 1954-55. The low yields in Trengganu for both wet and dry padi are attributed to the use of over-age seedlings, inefficient methods of cultivation and pest damage, the first mentioned of which was very largely brought about through delays in planting on account of the late onset of the monsoon.

Excellent crops are being harvested in Province Wellesley, parts of Perak, Selangor, Malacca and in some parts of Negri Sembilan, although in Negri Sembilan generally, late planting is likely to bring the average yield well below that of the previous season. Cutting tests in the coastal padi areas of Selangor have shown some extraordinarily high yields, ranging from 622 gantangs per acre in Sungei Burong to 933 gantangs per acre at Sekinchang, the latter being the average yield from 18 control plots in padi experiments on smallholders' land.

The prices paid for padi at the mill door in Kedah have been well above the Government support price of \$14 per pikul (133 1/3 lb.) since the beginning of February, and during the latter part of March as much as \$15.10 per pikul was being paid, with an average of \$14.95 per pikul.

There has been an improvement in padi marketing on the Selangor coast, where in previous years the Tanjong Karang Rice Mill has exercised a monopoly throughout the padi area. Last season, outside millers were allowed to purchase from the co-operatives in the northern part of the area, but all padi from Sungei Leman to the south had to pass through the Tanjong Karang mill which in turn sold padi surplus to its requirements to the Kuala Lumpur millers. This year, the millers have been given licences to purchase from the co-operatives in competition with the mill, which offers only the Government guaranteed minimum price less an average deduction of 7 per cent for moisture content. The smallholder now has the option of either selling his padi direct to the co-operatives, who have been paying \$13 to \$13.50 per pikul, or selling direct to the mill, according to which is the nearer and offers the better price. Prices obtained from dealers in Malacca ranged from \$13 to \$13.70 per pikul.

Padi fertiliser extension trials and demonstration plots, which have been laid down in all States and Settlements, have evoked a wide interest amongst padi planters and are undoubtedly leading to a better understanding of the use of fertilisers on padi. Although a response to fertilisers is frequently obtained, it is not always an economic one, and greater attention is now being paid to the dressings that can be economically applied to certain soil types. In Kedah, for example, the completion of the padi soil survey has enabled a link up to be made between the response to fertilisers and the soil type. On an area of 190 acres of third-class land at the new village of Kampong Tanjong, in Kedah, the yield was increased to 438 gantangs per acre by manuring, compared with 171 gantangs per acre in the surrounding unmanured land. On second-class land near Jitra, a small, cheap dressing of 140 gantangs of bat guano per acre and a top dressing of 60 lb. of sulphate of ammonia per acre raised the yield from 400 gantangs padi per acre to 530 gantangs.

The padi fertiliser subsidy scheme in Kelantan was continued up to the end of January, during which month a little over 66 tons of sulphate of ammonia was sold for top dressing late planted crops of padi. Total distributions for the season came to 19,967½ bags, each of 100 lb. weight, or very nearly 900 tons. This is the largest quantity distributed in the State in any one year since the scheme came into operation four years ago. This padi fertiliser subsidy scheme will be continued during the 1956-57 season, and tenders have already been called for the supply of fertilisers.

The use of fertilisers issued under the scheme in Malacca has brought generally favourable comment from padi planters, and with yield increases from 40 gantangs per acre upwards it seems probable

that there will be a greater demand, provided the rate of subsidy is not decreased.

In Trengganu and in much of Kelantan, padi harvesting methods still tend to follow the traditional cutting of each ear separately. At Kuala Akob in Trengganu, the *sabit* (sickle) and *tong* (tub) were introduced for use on the dry padi pilot scheme and met with ready acceptance by the men, but not by the womenfolk whose judgement was influenced by deep-rooted superstitions. The use of the *tong* has increased considerably in Kelantan since it was introduced many years ago, but its spread has been slow and only recently has it found its way to the District of Pasir Puteh.

Harvesting costs in Kelantan are around \$3 to \$3.75 per pikul of threshed grain when the work is done with a *sabit* and *tong*, compared with \$2.50 per pikul for unthreshed padi in the ear when harvested with the *ketaman* (a small knife held in the palm of the hand).

In Malacca, casual labour for harvesting is normally given payment in kind at the rate of six gantangs of padi per day for a man and three gantangs for a woman.

The Kuala Akob Dry Padi Pilot Scheme in Ulu Trengganu, which has been financed by the Rural and Industrial Development Authority, has now come to the end of its first season. The participants harvested a fair crop averaging 180 gantangs per acre, after using mechanical cultivation over the 28 acres covered by the Scheme, although one variety, Padi Melek, gave excellent yields of 240 to 300 gantangs per acre. After harvest, mechanical cultivation was used to prepare the land for off-season cropping with soya beans, maize, green manures, vegetables and Guinea grass. Of these, the soya beans gave promise of an excellent crop, no Guinea grass was planted and there was little interest displayed in vegetables until a prize of \$50 was offered for the best vegetable plot. The object of the Scheme was to replace shifting cultivation of dry padi with complementary cropping of the land with dry padi and off-season crops. The basis of the Scheme was mechanical cultivation with a sharing of the produce in accordance with the amount of labour put in by each family. Because the allocated funds are nearing exhaustion, the Scheme's future is uncertain.

Malacca seed farms planted with Nachin 57 have done very well, and several of them have given yields exceeding 700 gantangs per acre. These seed farms will serve the coastal areas of Malacca, for which this variety is particularly suitable, and the yields recorded on them this season give promise of much improved crops on smallholders' land.

Loss of nurseries in the Sungei Panjang area of Sabak Bernam, Selangor, due to unfavourable weather was followed up by the distribution of seed of the short term padi varieties Acheh Puteh and Taiwan, 560 gantangs of the latter being sent down from Province Wellesley.

Total distributions of seed during the quarter amounted to 1,507 gantangs of selected and 1,937 gantangs of unselected seed.

The use of a Swingfog unit for the control of *Leptocorisa* was

effectively demonstrated in several localities in Malacca using a Dieldrex-Dieselene mixture for fogging. Officers of the Department distributed 612 lb. of zinc phosphide for use in rat poison baits throughout the Federation during the quarter. Poisoning of rats was not the sole method of destruction employed, and communal rat drives organised in the Muar and Tangkak districts of Johore were estimated to have accounted for 10,000 rats.

The Report on the Census of Padi Planters in Kedah was completed during the quarter, and in the same State good progress was made with the field work of the Economic Survey, which was expected to be completed by the end of April.

Many meetings were held at all levels in connection with the formation of the Kedah Padi Planters' Association, which is organised in 18 Divisions, each sub-divided into Branches. All the Divisions had been formed by the middle of March.

The soils survey of Kedah padi lands was continued from the beginning of February, and up to the end of the quarter 316 points had been sampled, of which 232 points had been inspected and classified by the Soils Chemist.

The Kelantan Economic Survey was in progress in the field throughout the quarter and field work will shortly be completed.

Rubber.

There was a good fall of clonal seed during January and February, during which months 6,020,900 seeds were collected, making a total collection for the season of 22,899,300 seeds, of which 22,880,575 were actually sown in nurseries. Seed collection for the season then ceased, as the quantity collected was considered to be sufficient to meet known requirements for replanting and new planting. More than half (12,616,900) of the seeds collected came from Selangor, and the total collections are the highest yet attained.

During the period under review, the Rubber Industry (Replanting) Board was supplied with 472,592 clonal rubber stumps and 20,559 yards of rubber budwood for replanting, representing double the number of stumps supplied during the same period in 1955 and about 10 per cent less budwood.

There are still abundant stocks of clonal rubber seedlings in Departmental nurseries, and these have made it possible to meet all demands for new planting. Planters of new rubber holdings have taken up 284,460 clonal seedlings and 10,580 yards of budwood, which represent a four-fold increase in stumps and a 25 per cent reduction in budwood over the same period last year. This illustrates the dependence of the progress of new planting on the supply of clonal seedlings.

The production of clonal rubber seedlings in Pahang has been divided between nurseries on the Department's Stations, contract nurseries and kampong nurseries. The contract nurseries have been concerned solely with the production of stumps for supply to the

Replanting Board, whilst the others have been raising planting material for issue to planters of new rubber holdings. During the main seedfall of 1955, the Department's nursery on Temerloh Agricultural Station established 327,000 seedlings in the field, which represented 66 per cent of the seed supplied. The two kampong nurseries established 158,000 seedlings in the field, or 65 per cent of the seed supplied, while the contract nurseries established 322,000 seedlings in the field, equivalent to 60 per cent of the seed supplied. During the same period, another group of 32 kampong nurseries established 491,282 seedlings in the field, equivalent to 58 per cent of the seed supplied. Most of the seed obtained from the seedfall early in 1956 went into the Department's nurseries, which gave a 70 per cent establishment rate on the 228,400 seeds. As the maintenance of kampong nurseries has been described as generally fair but with insufficient weeding, it seems very probable that the present fairly small differences between nurseries may become accentuated when the time comes to count the numbers of pullable and usable stumps.

Sales of rubber latex to Malayan American Plantations in Kedah amounted to 155,692 lb. (dry rubber content) valued at \$114,010.57, compared with 202,292 lb. valued at \$186,655 during the previous quarter. There was a large fall in the purchases made under the latex purchasing scheme at Taiping. The fall in price of latex there from \$1.06 to 85 cents per kati (1 1/3 lb.) d.r.c. was associated with a drop in purchases of about one-third, to 229,309 lb. d.r.c. Also in Perak, the collecting stations at Behrang Station ceased to function when the rubber dealers concerned refused to form a syndicate as required by the Licensing Board, and at Sungkai latex purchasing ceased after the death of one of the partners in the firm. In North Johore, the 20 latex collecting centres continued to obtain adequate supplies, although two at Kampong Lukot in the Kota Tinggi area had to close down for lack of business.

In Kedah, new planting of rubber is being undertaken on the poor soils on the eastern side of the State and is frequently associated with catch cropping of tapioca, maize and dry padi. In Trengganu, applications for 3,560 acres of land for new planting have been approved, and Land Officers were kept fully occupied clearing up further arrears of applications for land. In comparison with this acreage for new planting, it was estimated that probably not more than half of the 1,600 acres accepted for replanting would actually be replanted in 1956. The new planting programme in Johore is based upon development of blocks which have been approved for rubber planting prior to applications having been received for individual pieces of land within those blocks. Two such blocks, of 1,500 acres each, were selected during the quarter.

The fall in the price of rubber during the quarter under review has resulted in the small rubber planter receiving about 25 per cent less for his produce, and this, together with the increase in the replanting grant to \$600 per acre, may result in a greater interest in replanting in some areas.

The group replanting scheme at Yong Peng, Johore, is now under way and represents the concerted action of a group of smallholders owning some 2,000 acres of land which is eligible for assistance under the Replanting Scheme. This group of smallholders has placed a contract for the clearing of their land in one of two ways: where the land is suitable, felling, burning, stumping, and lalang eradication by tractor ploughing, will be done at the rate of \$205 per acre; land that is difficult of access will be cleared by poisoning of the trees, and lalang will be eradicated by spraying at a cost of \$75 per acre. Lalang-free holdings will then be holed and planted with approved planting material at a cost of \$15 per acre. Subsequent maintenance of the holdings may then either be done by the landowner himself, or by the contractor at a fixed charge of \$6.50 per acre per month.

In Perlis, the progress of new rubber planting was held up on account of dry weather, and, as in Negri Sembilan, smallholders were advised to delay planting for a few weeks until there were better prospects of rain.

Planting of a 200 acre block of land by the Malay Co-operative Land Development Society of Rantau with ordinary seedlings for budding later has provided an exception to the common reluctance shown by most Malays to the planting of budded rubber. From Negri Sembilan also it is reported that there is a large amount of land under Approved Application which has not yet been developed, even though planting materials are immediately available from the Department of Agriculture.

Coconut.

Small rises within the price range \$25 to \$28 per pikul of copra were reported from Penang and Perak, but there was generally little change, and prices remained depressed in Trengganu where copra was fetching only \$16 to \$18 per pikul.

In Penang and Province Wellesley, the general standard of maintenance on coconut holdings has shown some improvement, and there is, in addition, a clear response to the activities of the staff of the Department who have been directing attention to the replacement of dead trees and the replanting of poor holdings. As an aid to this work, some 1,200 seed coconuts have been obtained from an estate and are being taken into the Department's Stations for germination, and after rejection of the poorer seedlings the remainder will be issued to smallholders for planting. In Perak, however, the low standard of maintenance of coconut holdings is considered to be one of the causes of low yields, and it is noted that holdings replanted with coconuts under the Rubber Replanting Scheme are all too rapidly becoming overgrown with lalang.

There has been an increase in the amount of damage done in Selangor by the beetle *Oryctes rhinoceros* L. on account of the felling of coconut trees during the construction of a new road at Sungei Haji Dorani. Around Kapar, in that State, there has been good co-operation from estates in the destruction of possible breeding grounds. The main

breeding centres now lie among the smallholdings and the trouble is made more difficult to deal with due to the absentee landlords.

In Malacca, a number of manual demonstrations have been laid down on old coconut holdings in the Bukit Rambai locality, using fertiliser mixture "J" at the rate of 10 lb. per palm plus 15 lb. of ground magnesians limestone per palm.

Coconuts are being planted on over 100 acres of land in Johore as an alternative crop to rubber under the Rubber Replanting Scheme, and this will bring in, for the first time, a widespread use of artificial fertilisers on coconuts in Johore.

The Johore Coconut Production Survey was commenced in the field at the beginning of 1956. The object of the survey is to obtain factual information on the acreage of coconuts on the west coast of Johore and an estimate of present production. Amongst the mass of information which it is expected to obtain will be the assessment of the present condition of the trees and the extent to which this is associated with drainage conditions and the intrusion of salt water, etc. It has been known for many years that the west coast coconut holdings had deteriorated badly, and that replanting of many holdings would probably be necessary after improvements had been carried out to the drainage system by the Drainage and Irrigation Department. The survey entails the field examination of a large number of plots selected at random, of which it is required that 250 plots shall actually be under coconuts. About half the 400 odd plots had been examined up to the end of the quarter, when it seemed very likely that an even greater number would have to be examined in order to get 250 plots actually under coconuts; it is therefore uncertain when the field work will be completed.

Planning of a coconut survey in Kelantan was commenced in March, and it is expected that field work will start during the next few months.

Coffee.

In Selangor, where the bulk of the coffee in the Federation is planted, there has been a fall in the price of beans, which now fetch from \$180 to \$210 per pikul. Although interest in the crop is still being maintained in that State, less is being planted as an alternative to rubber.

Other areas in which there is still an interest include Negri Sembilan, Malacca, Johore, and Kelantan, where it is being planted as a catch crop between young rubber. Kelantan is exceptional in showing a preference for Robusta rather than Liberica, this being attributed to the better flavour.

Food Crops and Vegetables.

The end of the north-east monsoon brought about the usual activity in vegetable planting in Kelantan and Trengganu on river banks and islands as well as in the padi fields, where there is a long

tradition of vegetable growing as an off-season crop on a scale sufficient to meet local market requirements. The weather in Kelantan was however rather too dry early in the year for crops to make their best growth, and there was common resort to small wells dug on the spot for hand watering, and, in a few instances, furrow irrigation was also practised. As in Trengganu, the popular crops are water melons, groundnuts, maize, cucumber, beans and chillies.

In the Cameron Highlands area, the production of vegetables decreased due to very heavy rainfall some weeks before the expected harvest. In particular the acreage under cabbage (variety Japanese Succession) decreased due to the heavy incidence of bacterial disease. There have been indications, however, that seedlings are more resistant to this disease than plants raised vegetatively. Seedlings and seeds have since been supplied to the farmers by the Department.

In Johore, artificial fertilisers were supplied through the Department at a reduced price. The demand for these was stimulated by the heavier demands on the fresh vegetable market occasioned by the adverse effects of drought on some varieties, such as occurred in Negri Sembilan. In Malacca, six tons of a NPK mixture were supplied through the Department for use on newly opened vegetable areas in new villages.

Selected varieties of the following vegetables were grown intensively by the Department to obtain seed for distribution to growers in Pahang and Trengganu:—spinach, long beans, groundnuts, soya beans, maize, ladies fingers, brinjal, etc.

In Pahang, five varietal and manurial extension trials were established in Kuantan District of three introduced Japanese varieties of water melon for comparison with the local variety, using proprietary NPK fertiliser and locally produced organic manures. This district alone has some 80 acres under water melons and might benefit from a change in variety and manuring practice.

Marketing of garden produce through co-operative societies to markets at considerable distances from the producing area is undertaken by growers in Bakri and Jementah in north Johore, whilst the Kuala Lumpur market also receives some of its supplies through the co-operative society at Subang, Selangor.

Fruit.

Fruit of the more important varieties was out of season and little was coming on to the market apart from banana, papaya, jambu and jack fruit. Some mangoes from the Jasin coastal area of Malacca were fetching \$8 per pikul sold green for pickling. The Lower Perak crop of mandarin oranges was beginning to come in and was being marketed at prices varying between \$26 and \$28 per pikul, a figure which appears low in comparison with the north Johore crop, which in August last year was quoted at nearly double that price. There is however no lack of confidence in the potentialities of the orange crop in Perak, and during the quarter a further 40 acres was planted in north Perak and another 100 acres

prepared for planting in the near future. In Kelantan, Penang and Province Wellesley, mangoes, durians and cashew nuts were in flower, and the mangosteen in the last two places.

A rapid increase in the demand for budded fruit trees, particularly rambutans, has left some States short of budwood of approved clones. Penang and Province Wellesley were supplying rambutan, and some durian, budwood to Kedah, Perak and Negri Sembilan for use in Departmental or commercial nurseries. It will however be some time before the expansion of budwood nurseries, which is going on in many States, becomes effective in increasing supplies, more particularly since a thorough check is being made of the trueness to type of the budwood used in nurseries. Until it becomes possible to identify fruit clones from vegetative characteristics, verification of the clones will continue to be a slow process, but there are hopes that at least a partial answer to this may be forthcoming in the comparatively near future.

For the first time in Selangor, Departmental production of rambutan and durian trees has exceeded the demand, and unless there is an unexpected rise in local demand there is every prospect that a surplus will become available for sale in other States and Settlements where there are still shortages. Also in Selangor, there is still a restriction on the output of budded trees from commercial nurseries necessitated by the shortage of budwood; in common with other States, expansion of budwood nurseries is being undertaken.

In Johore there is still a steady expansion of commercial nurseries, but there is a common tendency for these to outstrip their usually very limited supplies of budwood. The Department is trying to produce ample budwood to ensure that no inferior varieties are propagated by commercial nurserymen.

In Negri Sembilan there is evidence of fruit becoming more and more frequently planted in substitution for rubber under the Replanting Scheme, and planters have had to seek young trees from outside the State.

Bananas continue to be widely planted as a catch crop in new or replanted rubber; at least 200 acres was so planted in Perak during the quarter. In Negri Sembilan, on 400 acres planted during the early part of 1955, bananas are now coming into bearing and, with fair average yields, are making a useful contribution to the owners' incomes.

The production of budded fruit trees from the Department's Stations during the quarter amounted to 14,414 trees, in addition to which 270 seedlings were sold. This output is proportionately comparable with that for the whole of 1955, although it shows an increase of about 1,500 trees over the corresponding period of 1955.

Pineapple.

Development of the Kampong Selabak smallholdings has been held up on account of a change in plans for the drainage of the area, but this work has recommenced and is once more proceeding satisfactorily. Those

parts of the area which were planted last year now carry pineapples which are coming into bloom, and it will not be long before fruit are produced.

In Selangor, there has been a great improvement in the mutual understanding between growers and the canner, and both parties are now beginning to appreciate each others point of view as to the grade of fruit required. There has not been a single complaint from either party during the quarter.

Established smallholders' pineapple areas in Kuala Langat district of Selangor are badly maintained, and it has seemed impossible to arouse the growers' interest in any improvements suggested. Although representatives of these growers had the opportunity of attending discussions in Johore on the formation and operation of smallholders' co-operatives, none has yet made any progress towards the formation of any co-operative fruit selling organisation.

Fruiting in the Sekinjang area of Selangor has been remarkably uniform, but the harvest has not yet been large enough to warrant the transport of fruit to the canning factory and it is at present being sold in the local market. The recently completed improvements to the internal road system in this area should make the marketing of the crop very much easier than was originally thought likely.

Pineapples in Negri Sembilan have been commonly planted as a catch crop in young rubber. In such conditions considerable damage may be done by wild pigs under the circumstances of the Emergency, which prohibits their shooting.

In the Pontian district of Johore, from 70 to 80 per cent of the rubber holdings being replanted under the Rubber Replanting Scheme are being planted with pineapples as an alternative crop. Fruit Collapse, caused by a bacterium which may also cause heart-rot in younger plants, continues to cause serious losses. The distribution of this disease, which until recently had been confined to the State of Johore but has since been reported from other areas, is extremely sporadic and tends to be at its worst in the second and third crops from recently planted holdings. One group of pineapple plantings has recently suffered up to 70 per cent loss of crop from this disease, and methods of control are being urgently sought. One treatment being tried in the field is spraying with streptomycin sulphate.

The Pineapple Co-operative Marketing Societies at Pekan Nanas and Ayer Hitam (Muar), Johore, have been doing good business despite keen competition from middlemen. Although there have been complaints about the excessive rejection of fruit at the cannery, there is little doubt that the formation of these Societies has already been of considerable value to the small growers, and that they have been instrumental in improving the quality of fruit delivered to the cannery up to a standard which has been much more closely in accordance with canners' requirements.

Cacao.

Field work commenced on the Jerangau Road Cacao Pilot Scheme on the 1st January with the clearing, lining and holing of the first 24 acres of land, which is due to be planted in October and November this year. By the end of the quarter this work had been completed, and materials in the form of wood veneers, baskets, fertilisers, attap, etc. had been assembled in readiness for the start of nursery work in early April. There is a high degree of enthusiasm for this Scheme and excellent progress has been made.

The Pahang Scheme has still not started, and there are continued difficulties over the provision of funds.

The Department's observation plots and seed gardens are doing well at Batang Merbau in Kelantan, Sungei Tong in Trengganu, and in certain of the Parit riverine kampongs in Perak where small plantings of cacao have been made under mixed kampong cultivation. Excellent growth has been made on the Sungei Tong plot on the five-acre block which was planted last quarter, and underbrushing and lining has been commenced on a new 15-acre extension to be planted later this year.

The trial planting by an estate at Sungei Durian in Kelantan has shown some improvement after thinning out the overhead shade. The owner sent two of his staff to the Federal Experiment Station, Jerangau, for a short course on cacao, and on their return clearing and underbrushing of a 15-acre extension area was undertaken. An estate in Province Wellesley which has a good plot of cacao growing under coconuts has recently been supplied with 70 cacao pods for the provision of seed to enable the trial planting to be extended.

In Negri Sembilan the trees in the seed garden at Ampang Tinggi which commenced to come into bearing at an age of 2½ years continue to do well. Four acres of jungle adjoining the Sungei Buloh Extension Station have been selected as a site for another seed garden, and trace cutting, underbrushing and lining have been commenced.

Livestock.

PIGS

The market was glutted in Kedah at the time of Chinese New Year and a small drop in price took place. Elsewhere the fall in price to \$80 to \$85 per pikul did not take place until after the holiday. With the price of feeding stuffs still high, breeders are inclined to rear reduced numbers of pigs.

Fifty-five Middle White boars and 81 gilts were sold or issued on loan for stud purposes by the Department during the quarter, and there were 186 services recorded, the majority of which took place in new villages. The Department's boars are in the greatest demand in Malacca and Johore, whereas in Selangor there is little demand for services as there is a sufficient number of privately-owned Middle White boars in the State.

Arrangements have been made in Selangor for the import from the United Kingdom of two Middle White boars for use with the Department's breeding herd, from which most private owners obtain their supplies.

In the Larut and Matang areas of Perak, the introduction of Middle White blood is beginning to make itself felt, and butchers are paying a premium of about \$2 per pikul for Middle White crosses. In Negri Sembilan, many half-breds are being reared in the new villages, where there is an extremely keen demand for both weaner boars and gilts, and it is stated that they are fetching premia as high as \$12 per pikul.

A progressive pig farmer in Paya Terubong, Penang, has imported, from Australia, a pair of pure-bred Berkshire pigs. This is a breed of which there are few examples in this country at present.

Cameron Highlands remained the largest supply centre for the Department's Middle White pigs, and during the quarter distributed 61 weaners to Pahang, Malacca, Perak, Kedah, and Johore.

POULTRY

There are reports from several States of a declining interest in pure-bred birds, in consequence of which there has been a tendency to reduce the size of some of the Department's flocks.

A poultry exchange scheme which was undertaken at Dabong in Ulu Kelantan last year led to the exchange of local birds for 56 Rhode Island cockerels. There are now some cross-bred progeny from these and the owners consider them to be more rapid growing than the ordinary kampong fowl.

Pure-bred Rhode Island Reds in Selangor, imported as eggs from the United Kingdom about a year ago, are showing themselves to be good egg layers and at 11 months of age are averaging 67 per cent production. A decline in production is commonly experienced however with each successive generation bred in this country.

Two Malay padi smallholders in Province Wellesley North have taken up a lucrative duck rearing system. They have been buying in up to 1,000 ducklings at padi harvest and running them on the fallow padi fields where they eat the fallen grain in addition to other natural food. It is claimed that after keeping them for 2½ months, during which time they also receive locally produced fish refuse and a little tapioca, they can be sold at a profit of 85 to 90 per cent of the original outlay. There is little doubt that substantial quantities of duck and poultry food go to waste after padi harvest, and that subject to satisfactory marketing arrangements the system should be capable of considerable expansion in other parts of the country.

Agricultural Education.

The new Training Centre in Kelantan was completed in February and the first course, which was a general one, was held in March and lasted for two weeks. The trainees consisted of 12 short-listed applicants

for vacancies in the appointments of Junior Agricultural Assistant and two members of the Federation Military Forces undergoing resettlement training. The syllabus covered padi, rubber, fruit, cacao, vegetables, livestock and fodder crops, and included visits to Melor and Batang Merbau Agricultural Stations as well as to rubber nurseries and small rubber holdings being replanted under the Rubber Replanting Scheme.

Seven courses of 11 days each on rubber planting were held at Gajah Mati, Kedah, for the benefit of 45 Malays and seven Chinese. No courses were held in Province Wellesley on account of preoccupation with padi harvest, and the opportunity was taken to install electricity in the school building.

Four courses were held for kampong youths at Cheras, Selangor, for a total of 47 youths from Ulu Langat, Ulu Selangor, Klang and Kuala Selangor Districts, of whom the boys from the last mentioned district were outstanding for their industry. Out of 14 boys who had arranged to attend one of the courses, no less than 11 dropped out at, or shortly after the start of the course, which gives emphasis to the need for the very careful selection of the trainees.

Subjects in which practical instruction was given at the Training Centre at Pekan, Pahang, included plant propagation, the maintenance of rubber, fruit and coconut holdings, and the control of pests and diseases. Two courses were held at this centre, and persons attending the second course had the opportunity of budgrafting rubber seedlings at Paya Besar as well as planting coconuts at the Pekan Arabic School. Altogether, 27 trainees attended the courses.

Three poultry courses were held at Chembong, Negri Sembilan, and one of the trainees was an aborigine from Fort Iskandar in Pahang.

Training in agriculture has been given in Kelantan, Province Wellesley, Pahang and Negri Sembilan to members of the Federation Military Forces as part of their resettlement training to better fit them for their return to civilian life. Altogether, nine members of the armed forces have attended courses during the quarter, some of them for as long as two months.

Several States and Settlements, including Kedah, Selangor, Malacca and Johore, have been making use of colour slides for illustrating talks, and although not in themselves a substitute for "live" demonstrations, such slides are at times a most useful aid to raising interest and preparing the way for further work later.

The complaint is not infrequently heard that visitors rarely come on their own initiative to look round Agricultural Stations and Padi Test Plots. That it is not invariably true is shown by Cheras Agricultural Station, where, although a great number of visitors do not sign the visitors' book, more than 200 of them did so during the quarter. It is usual for there to be a number of visitors enquiring after planting material or poultry, or just calling in out of general interest. In other areas, organised Field Days have been used as a means of bringing people in. Kelantan held two Field Days for the benefit of 60 young

people, whilst Pahang held four. In Trengganu, one such Field Day completely changed local opinion as to the need and advisability of extending an irrigation scheme. Mainly by arranging for organised parties of school children and catering for Boy Scouts taking their Smallholder's Badge, Agricultural Stations in Penang and Province Wellesley had over 1,500 visitors during the quarter, and both Negri Sembilan and Malacca went in for the same type of activity with conducted tours by school children.

In Kuala Kangsar, a successful six day course was held for 75 persons taking instruction in rubber growing as the main subject, with fruit, padi and control of lalang as subsidiary interests.

The last of the current series of padi courses held at Bukit Merah Padi Station for the benefit of groups of boys from Malay, Chinese and English schools dealt with the harvesting of padi. These courses started in 1953 and cover annually all aspects of growing a crop of padi.

Two courses given by the Rubber Instructors at Batu Pahat and which have been running for some months have also come to a close.

Demonstrations carried out either on smallholders' land or on the Department's Stations have been too numerous to mention individually. All the major crops were covered, as well as some livestock. Particular mention should be made of the part played by the staff of the Smallholders' Advisory Service of the Rubber Research Institute in the giving of instruction in the growing and manufacture of rubber.

The Department played a part in the running of at least 16 Civics Courses.

Newsletters were issued in three States, and a change was made in the coastal area of Selangor where instead of the usual type of newsletter being published, a broadsheet was issued for posting in mosques and places where people are likely to gather. This form of publication is being tried out to see whether it is more likely to provoke discussion.

An increasing amount of attention is being paid to the follow-up in extension work, one of the objects of which is to ensure that contacts made with smallholders are exploited as fully as possible. Several recording systems are being tried out in the field to facilitate the maintenance of contact between individuals and officers of the Department.

Schemes for Ex-Special Constables

Progress with Kampong Jaya Stia (Kg. Traill), Bukit Badong, Selangor, has continued to be very satisfactory and there are now 165 families in residence, and additional houses are under construction. The donation of a shield and prizes in cash by a local planter has stimulated competition, and in particular the development of the kampong area has been most impressive. A site has been reserved for the construction of a kampong type house for a Junior Agricultural Assistant to be stationed there shortly.

At Bukit Kuching, in the same State, progress is good and indeed better than at Kampong Jaya Stia. At Sekinchang, too, the settlers are

extremely hard working and have been obtaining very good returns from their vegetable plots. Their handling of the peat land is an object lesson in what can be done under very difficult conditions by people who have the will to succeed.

Outside of Selangor, where the more successful of the settlements have developed, there has been satisfactory progress at Bagan Bharu, Ijok, Perak. Here, 43,500 clonal rubber seedlings were planted out during the quarter. Most other settlements have a long way to go before they achieve their object.

Departmental Notes

Honours and Awards

His Highness the Sultan of Kedah was pleased to confer the Kedah Distinguished Service Star on Mr. E. J. H. Berwick, Senior Agricultural Officer, on the 24th May, 1956.

It was announced in the Queen's Birthday Honours List, 1956, that Her Majesty had been pleased to appoint Che Mohamed Ramly bin Haji Tahir, Assistant Agricultural Officer, Perak, to be an Honorary Member of the Most Excellent Order of the British Empire.

Retirement of Tuan Haji Mohd. Salleh bin Musa

Tuan Haji Md. Salleh bin Musa, Assistant Agricultural Officer, Kedah, retired on the 2nd March, 1956. Haji Salleh joined the Kedah agricultural service in 1925 and has remained in Kedah since then. He was an outstanding officer in the Department in Kedah and devoted himself unsparingly to his work on padi experimentation which has resulted in the selection and distribution of improved strains to the padi planters, thereby increasing yields considerably. During the Japanese and Siamese occupations of Kedah he was personally responsible for maintaining the purity of selected strains of padi at Telok Chengai Padi Experiment Station, and since the liberation has been in-charge of most of the experimental work on this Station, earning for Kedah her very high reputation for accuracy in padi experimentation. He had a special flare for statistical work and spent much time and thought on the organisation of crop cutting tests.

In 1948 he acted temporarily as State Agricultural Officer, Kedah and Perlis, and in 1953 His Highness the Sultan was pleased to confer upon him the Kedah Meritorious Service Decoration.

He acted as interpreter to the Federal Rice Committee in 1955 and was Secretary of the Kedah Rice Committee. His knowledge of the cultivation of padi in Kedah and his understanding of the padi planters were invaluable to these Committees and he was instrumental in organising the Kedah Padi Planters' Association and the Kedah Padi Planters' Board.

Haji Salleh has retired in order to put into practice and demonstrate the principles of agriculture which he has been teaching throughout his long career. We wish him every success in his new venture and a long and happy retirement.

E. J. H. B.

Retirement of Enche Mohamed Ramly bin Haji Tahir, O.B.E.

Che Mohamed Ramly bin Haji Tahir, Assistant Agricultural Officer, left the Department on retirement at the beginning of May, 1956.

Che Mohamed Ramly joined the Department as a Malay Apprentice in 1925 and, after training, became an Agricultural Assistant in 1927. In 1931, he was posted to Perak where he remained until his retirement. The last 19 years of his service were spent in Kuala Kangsar, and it was here that he received his promotion (in early 1947) to Assistant Agricultural Officer. The Department suffered an acute shortage of staff between 1948 and 1953, and during this period Che Mohamed Ramly was in charge of the Perak Central Circle—normally the responsibility of an Agricultural Officer—and worked most efficiently. He took a prominent and active part in local affairs including membership of the Local Defence Corps in 1941. In more recent years he became a well known figure in politics and was one of the promoters of the Parent/Teacher Association in Kuala Kangsar.

Che Mohamed Ramly will always be remembered by the officers with whom he worked for his energy and drive. His personal initiative and readiness to assume responsibility are outstanding and this, together with his high personal integrity and ability to imbue his staff with some of his drive (he is a strict disciplinarian), made him an extremely efficient officer whose retirement leaves a gap in our ranks which will be difficult to fill.

For his services to agriculture in Malaya, Her Majesty the Queen was graciously pleased to award him the O.B.E. in the recent Birthday Honours.

Che Mohamed Ramly is not entirely lost to the cause of agriculture in Malaya as he has taken a post with the Rubber Industry (Replanting) Board in Selangor, in which all his colleagues in the Department will wish him every success.

L.V.

Promotions

The following officers of the Department have been promoted:—

Che Omar bin Buyong, Pupil Agricultural Officer, to be Agricultural Officer with effect from the 12th August, 1955.

Mr. Van Thean Kee, Pupil Botanist, to be Botanist with effect from the 12th September, 1955.

Che Ahmad bin Mohd. Amin, Pupil Agricultural Officer, to be Agricultural Officer with effect from the 12th September, 1955.

Mr. P. G. Coleman, Agricultural Officer, to be Senior Agricultural Officer with effect from the 13th October, 1955.

Mr. F. B. Brown, Botanist, to be Senior Botanist with effect from the 9th January, 1956.

Mr. H. J. Simpson, P.J.K., Senior Agricultural Officer, to be Assistant Director of Agriculture (Field) with effect from the 14th January, 1956.

Mr. H. M. James, M.C., Agricultural Officer, to be Senior Agricultural Officer with effect from the 14th January, 1956; and

Mr. J. K. Coulter, Chemist (Soils), to be Senior Chemist (Soils) with effect from the 14th January, 1956.

Appointments

The following appointments have been made:—

Mr. J. S. Ure, Agricultural Officer, to be Agronomist-in-charge, Federal Experiment Station, Serdang, with effect from the 7th March, 1956.

Dr. C. C. Webster, Deputy Director of Agriculture, to act as Director of Agriculture with effect from the 14th March, 1956.

Mr. H. J. Simpson, P.J.K., Assistant Director (Field), to act as Deputy Director of Agriculture with effect from the 14th March, 1956.

Mr. H. K. Ashby, Senior Agricultural Officer, to act as Assistant Director (Field) with effect from the 11th April, 1956.

Mr. H. M. James, M.C., Senior Agricultural Officer, to be State Agricultural Officer, Johore, with effect from the 11th April, 1956.

Mr. P. Class, Agricultural Officer, to be State Agricultural Officer, Negri Sembilan, with effect from the 25th April, 1956.

Mr. T. R. Dickinson, Agricultural Officer, to be Settlement Agricultural Officer, Malacca, with effect from the 27th April, 1956.

Mr. G. S. Keeping, Agricultural Officer, to act as State Agricultural Officer, Pahang, with effect from the 5th May, 1956; and

Mr. R. Henderson, M.C., Agricultural Officer, to act as Senior Agronomist with effect from the 12th May, 1956.

Leave

The following officers have returned from leave:—

Mr. J. S. Ure, Agricultural Officer, on the 5th March, 1956.

Mr. H. M. James, M.C., Senior Agricultural Officer on the 4th April, 1956.

Mr. R. Henderson, M.C., Agricultural Officer, on the 5th May, 1956.

Mr. H. Ritchings, Horticultural Officer, on the 15th May, 1956; and

Mr. D. W. M. Haynes, Agricultural Engineer, on the 21st May, 1956.

The following officers have proceeded on leave:—

Mr. R. G. Heath, Director of Agriculture, on the 15th March, 1956;

Mr. R. J. A. W. Lever, Entomologist, on leave prior to retirement on the 15th March, 1956.

Mr. H. D. Matheson, Agricultural Officer, on the 2nd May, 1956.

Mr. A. L. Barcroft, Agricultural Officer, on the 5th May, 1956; and

Mr. E. F. Allen, Senior Agronomist, on the 12th May, 1956.

Statistical

MARKET PRICES

January to March, 1956.

Rubber.—There was a further decline in the Singapore price of R.S.S. No. 1 during the quarter, including a drop below the \$1 per lb. mark.

The Singapore Market was closed on the first two days of the year, and on the 3rd January the price (f.o.b. in bales, buyer) was 127.375 cents, nearly 2 cents below the average price for December, 1955. There were fluctuations in the price from day to day but there was a general downward movement until the price reached 105.75 cents on the 25th of the month. The price was back to 111.25 on the 28th but had fallen to 107.25 by the last day of the month. The average price for January was 114.984 cents per lb.

The downward movement continued in February and the \$1 mark was lost on the 21st, when the noon price in Singapore was 97.625 cents. The highest and lowest prices during the month were 109.25 and 93.75 cents respectively and the average price 102.636 cents per lb.

In March, the \$1 mark was topped on three occasions (the 5th, 6th and 13th) but the average for the month dropped to 97.01 cents per lb. The highest and lowest prices were 102.125 and 90.75 cents respectively.

The prices quoted above are the noon prices as reported by the Singapore Chamber of Commerce and they have been taken from the Monthly Statistical Bulletin of the Federation of Malaya.

The average prices paid for smallholders' rubber at three towns in the Federation of Malaya are given in Table I.

Table I.
Average Monthly Prices Paid by Local Dealers for
Smallholders' Rubber, January to March, 1956.
(Dollars per pikul of 133 1/3 lbs.)

Grades.	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
Smoked Sheet No. 1	118.08	107.55	103.55	117.90	108.58	104.37	—	—	—
Unsmoked Sheet	106.65	93.88	89.54	94.79	83.77	84.48	100.13	94.81	90.40
Scrap	47.59	46.11	50.08	57.35	48.42	55.49	32.50	30.67	36.96

This table has been compiled from statistics supplied by the Chief Statistician, Federation of Malaya.

Palm Oil.—The average prices paid in London for palm oil were, in Malayan dollars per ton:— January 670.71; February 675.86; and March 681.43.

Tea.—The Chief Statistician, Federation of Malaya, reports that 1,245,000 lb. of tea was produced in Malaya during the quarter.

The average prices paid for Ceylon teas at the sale held in Colombo on the 28th March, 1956, and as reported in the Weekly Report of the Colombo Brokers' Association, were, in rupees per lb.:—High Grown Teas (4,000 ft. and above) 2.64; Medium Grown Teas (2,000 to 3,999 ft.) 2.00; and Low Grown Teas (below 2,000 ft.) 1.93.

Derris.—The price of derris remained at \$110 per pikul.

Table II.
Singapore Prices of Various Agricultural Products.
(Dollars per pikul)

Date	Copra, Sundried	Coconut oil *	Pepper. F.A.Q. Muntok white	Pepper. Gen. Muntok white	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
1956								
3rd Jan. -	27.50	43.25	143.00	153.00	46.00	12.625	17.50	18.00
9th Jan. -	27.50	43.00	143.50	153.50	45.00	12.625	17.50	17.50
16th Jan. -	27.50	42.75	139.50	149.50	45.00	12.625	17.75	17.00
23rd Jan. -	27.25	42.50	136.00	146.00	45.00	12.50	17.75	17.00
30th Jan. -	27.50	43.25	143.50	153.50	46.00	12.50	17.75	17.00
6th Feb. -	28.00	43.00	133.50	143.50	46.00	12.50	17.75	17.25
15th Feb. -	28.00	43.50	135.00	145.00	46.00	12.50	17.75	17.25
20th Feb. -	27.75	43.50	134.00	144.00	46.00	12.50	17.75	17.00
27th Feb. -	27.50	43.75	132.50	142.50	50.00	12.625	17.75	16.50
5th Mar. -	27.75	43.50	132.50	142.50	50.00	12.75	17.75	16.50
12th Mar. -	28.25	44.00	129.50	139.50	50.00	12.75	17.75	16.50
19th Mar. -	29.00	44.75	126.00	136.00	50.00	12.625	17.75	16.50
26th Mar. -	29.00	44.25	124.00	134.00	50.00	12.375	17.75	16.50

* F.O.B. in second-hand drums.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce,

FEDERATION OF MALAYA

PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month	PALM OIL		PALM KERNELS	
	1955	1956	1955	1956
January ..	4,093	3,712	1,124	1,038
February ..	3,997	3,697	1,081	1,013
March ..	4,854	4,520	1,300	1,229
April ..	4,630		1,221	
May ..	4,152		1,076	
June ..	5,135		1,256	
July ..	4,802		1,238	
August ..	5,128		1,348	
September ..	5,073		1,269	
October ..	4,855		1,262	
November ..	4,952		1,348	
December ..	4,820		1,366	
Total ..	56,491	(11,929)	14,889	(3,280)

In March, 54 estates were in production out of a total of 61 oil palm estates.

MALAYAN AGRICULTURAL EXPORTS, OCTOBER-DECEMBER, 1955.

Product	NET EXPORTS IN TONS			
	Year 1954	Year 1955	Oct.-Dec., 1954	Oct.-Dec., 1955
Arecanuts	5,511	13,679	3,278	3,423
Coconuts, fresh †	94,433 †	72,140 †	22,624 †	2,204 †
Coconut oil †	78,507	91,176	17,336	25,958
Copra †	67,472 *	75,076 *	19,828 *	17,005 *
Copra cake	40,520 *	56,404 *	10,378 *	14,929 *
Gambier, all kinds	134 *	66	43 *	39 *
Palm Oil	48,908	52,832	10,830	13,285
Pineapples, canned	21,533	27,756	3,026	4,438
Rubber ‡	585,081 §	637,463	159,329	168,668
Sago,—flour	27,980	23,053	6,243	5,956
Sago,—pearl	5,122	5,483	1,732	1,022
Sago,—raw	27,021 *	18,709 *	5,231 *	4,370 *
Tapioca,—flake	49	475	83	209
Tapioca,—flour	4,555 *	3,979 *	1,035 *	772 *
Tapioca,—pearl	7,865	5,470	2,027	1,260
Derris	16	13	3	3
† Copra equivalent	88,943	74,528	8,795	25,221

‡ production (Federation of Malaya). † hundreds in number. * net imports.

§ This figure includes an adjustment of † 2,090 tons shown in annual returns.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

MONTH	ESTATES		SMALLHOLDINGS (ESTIMATED)		TOTAL	
	1955	1956	1955	1956	1955	1956
January	29,260	32,515	26,033	26,428	55,293	58,943
February	28,497	27,503	21,928	23,848	50,425	51,351
March	27,465	28,408	24,874	22,433	52,339	50,841
April	24,155		20,415		44,570	
May	27,355		22,331		49,686	
June	27,497		22,841		50,338	
July	30,238		25,647		55,885	
August	30,650		23,571		54,221	
September	31,274		24,764		56,038	
October	30,724		23,960		54,684	
November	30,174		21,743		51,917	
December	34,893		27,174		62,067	
Total	352,182	(88,426)	285,281	(72,709)	637,463	(161,135)
Total 1954	344,851		240,230		585,081	

This Table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

Production on smallholdings (estates of less than 100 acres) is taken as the total of purchases from smallholders reported by licensed dealers.

FEDERATION OF MALAYA
PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.
(in tons)

MONTH	COPRA PRODUCTION				COCONUT OIL PRODUCTION		COPRA CAKE (POONAC) MANUFACTURED	
	Estates (a)		Smallholdings (estimated)		Oil Mills		Oil Mills	
	1955	1956	1955	1956	1955	1956	1955	1956
January	2,674	2,728	4,297	7,808	6,971	10,536	3,561	5,197
February	2,797	2,713	8,366	8,457	11,163	11,170	4,808	4,612
March	2,975	3,032	7,726	6,463	10,701	9,495	4,603	5,242
April	3,021		7,478		10,499		3,934	
May	3,619		7,630		11,249		4,580	
June	3,748		10,534		14,282		5,128	
July	3,955		12,311		16,266		5,400	
August	4,188		10,275		14,463		5,370	
September	3,745		9,511		13,956		5,749	
October	3,591		9,730		13,321		5,787	
November	2,850		8,486		11,336		5,758	
December	3,301		7,180		10,481		5,062	
Total	40,464	(8,473)	103,524	(22,728)	143,988	(31,201)	59,740	(15,051)

Notes:—1. The above Table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

(a) Includes copra equivalent of sales of fresh nuts by estates.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1955.

Locality	Air Temperature Degrees Fahrenheit					Earth Temperature			Rainfall						Bright Sunshine																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	Means of			Absolute Extremes		At 1	At 4	Total	Most in a day	Number of days					Total	Daily Mean	Per Cent.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	A.	B.	Min.	Means of A and B	Highest	Lowest	Max.			Min.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.				Gale force 8 or more																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1956.

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature			Rainfall							Bright Sunshine	
	Means of			Absolute Extremes				At 1	At 4	Total	Most in a day		Number of days					Total	Daily Mean
	A.	B.	Max.	Min.	Means A and B	Highest	Lowest	Max.	Min.										
											Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more				
Ipo, Perak	90.2	71.3	80.7	93.2	67.0	84.3	74.0			in. 8.39	mm. 213.1	in. 3.01	14	13	4		193.50	6.24	
Kuala Lumpur, Selangor	87.9	71.8	79.9	92.6	68.9	77.2	74.0			10.48	266.2	1.69	16	15	8	5	196.55	6.34	
Sitiawan, Perak	87.7	71.3	79.5	90.2	67.7	83.9	73.6	82.7	84.1	4.48	113.8	0.79	20	17	3	1	102.25	3.30	
Kuantan, Pahang	82.5	69.7	76.1	86.8	62.7	75.6	73.4	77.4		17.48	444.0	4.50	20	15	1	1	220.40	7.11	
Bayan Lepas, Penang	87.2	72.1	79.7	91.0	67.5	82.8	75.2			3.33	84.6	1.03	10	10	5		158.85	5.12	
Malacca	85.7	72.0	78.9	90.1	68.5	74.3	74.7			7.21	183.1	2.27	14	10			114.30	3.69	
Mersing, Johore	81.2	72.2	76.7	85.0	67.4	77.4	75.9			25.95	659.1	12.92	17	15		2	234.65	7.57	
Alor Star, Kedah	88.9	69.4	79.1	92.2	63.6	85.0	75.4			1.90	48.3	0.89	5	4	1		179.15	5.78	
Kota Bharu, Kelantan	82.7	72.3	77.5	84.5	67.0	78.4	77.9	80.7	82.0	10.60	269.2	5.20	5	13	9		152.85	4.93	
K. Trengganu, Trengganu	81.7	71.3	76.5	84.0	65.2	78.5	75.0			6.19	157.2	1.20	17	13			115.15	3.71	
Singapore	83.8	72.7	78.3	88.3	69.5	78.3	78.3			13.87	352.3	4.07	18	15		1			
HILL STATION																			
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	71.6	54.0	62.8	76.0	45.4	67.2	60.0			5.71	145.0	1.32	15	12			123.25	8.97	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1956.

Locality	Air Temperature Degrees Fahrenheit					Earth Temperature		Rainfall					Bright Sunshine			
	Means of			Absolute Extremes		At 1	At 4	Total	Most in a day	Number of days				Total	Daily Mean	
	A.	B.	Min.	Max.	Min.	Max.	Precipitation .01 in or more			Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force or more			
Ipoh, Perak	92.9	72.1	82.5	96.2	69.0	85.3	75.6	in. 5.95	mm. 151.1	in. 3.06	10	8	5		hr. 221.10	hr. 7.62
Kuala Lumpur, Selangor	90.5	72.6	81.5	95.2	70.2	84.0	75.1	7.69	195.3	1.47	12	10	6	6		
Sitiawan, Perak	89.1	72.0	80.5	91.7	70.1	86.2	74.4	3.89	98.8	0.86	12	10	5	3	219.60	7.57
Kuantan, Pahang	86.1	69.7	77.9	89.3	65.8	81.4	73.2	7.30	185.4	3.19	9	8			201.35	6.94
Bayan Lepas, Penang	88.2	72.7	80.5	90.6	70.4	84.3	75.6	6.01	152.7	2.24	11	9	6		234.55	8.09
Malacca	88.4	72.8	80.6	92.9	70.4	83.6	75.4	6.83	173.5	2.32	13	10	2	1	183.10	6.31
Mersing, Johore	83.2	72.1	77.7	85.0	67.0	79.0	76.1	4.00	101.6	1.90	10	8			218.85	7.55
Alor Star, Kedah	92.8	70.2	81.5	95.9	66.1	85.6	72.6	2.77	70.4	1.69	4	4	1		246.20	8.49
Kota Bharu, Kelantan	85.0	72.0	78.5	87.5	67.0	82.2	77.2	2.18	55.4	1.55	8	5		3	254.25	8.77
K. Trengganu, Trengganu	83.9	71.0	77.5	86.4	66.7	80.3	75.7	2.40	61.0	0.78	8	7			238.60	8.23
Singapore	87.0	73.5	80.3	89.8	71.2	79.5	76.1	8.76	222.5	1.90	12		4		180.05	6.21
HILL STATION																
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	73.9	52.2	83.1	79.0	45.4	67.4	61.0	3.14	79.8	1.31	12	12			176.70	6.09

Compiled from Returns supplied by the Malayan Meteorological Service.

